

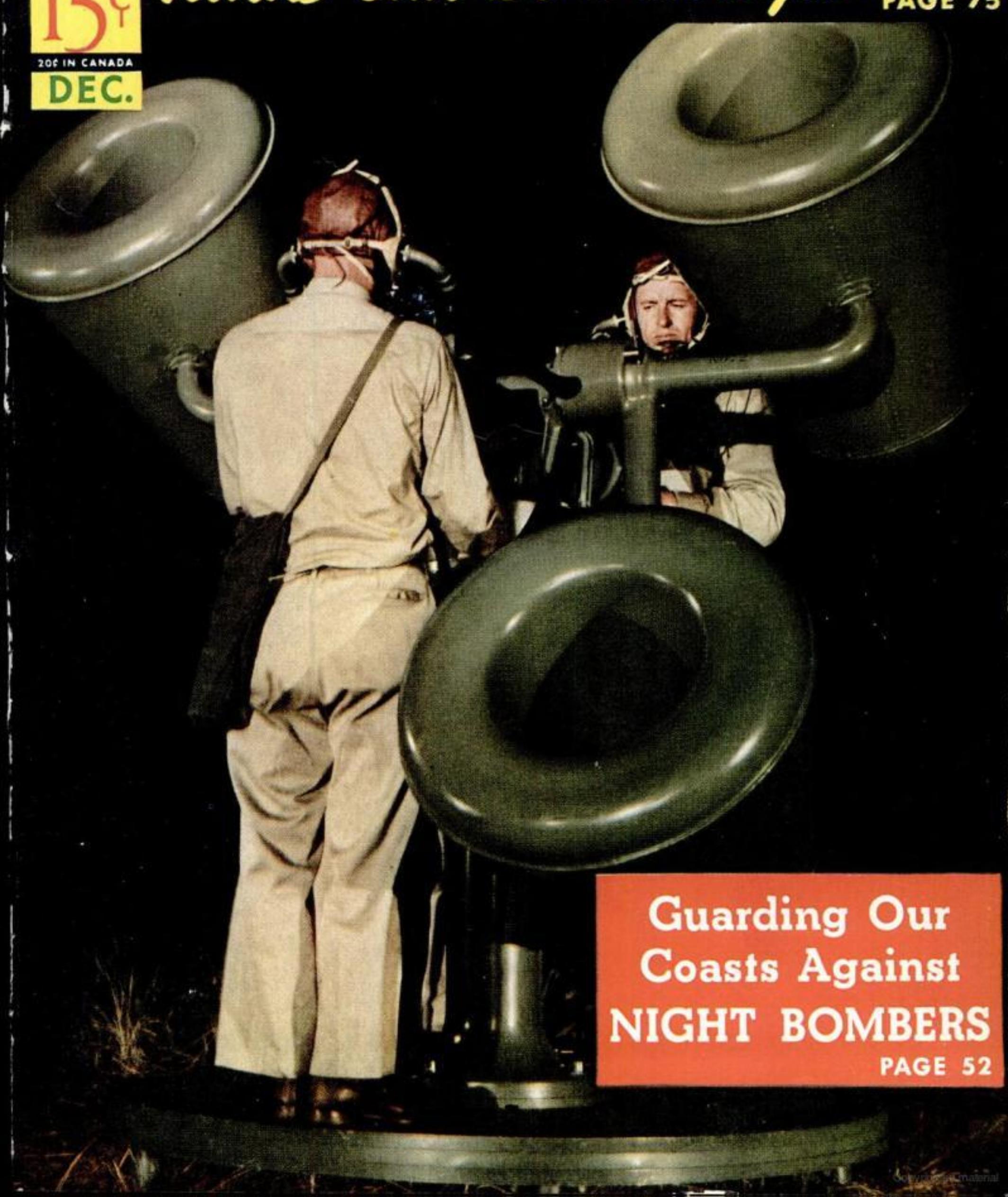
# POPULAR SCIENCE

MONTHLY

15¢  
20¢ IN CANADA  
DEC.

## Tanks Can Be Destroyed

PAGE 75



Guarding Our  
Coasts Against  
**NIGHT BOMBERS**

PAGE 52

# "PRESTONE" ANTI-FREEZE

## *in National Defense*



"PRESTONE" ANTI-FREEZE is going aloft in many of America's new liquid-cooled fighting planes... playing a vital part in their efficient performance... and in the nation's defense!



**GETTING THERE** "fustest with the mostest men" is the idea behind Uncle Sam's motorized troops. The "Prestone" anti-freeze in their transport and supply trucks will never fail them!



**UNCLE SAM'S NAVY** is the most powerful afloat. "Prestone" anti-freeze helps keep our ships in fighting trim! U. S. S. Ranger, aircraft carrier, shown above, is one of the many important naval vessels whose mechanism is protected by "Prestone" anti-freeze.



**OUR SPEEDY PATROL TORPEDO BOATS** . . . "mosquitoes" with a lethal sting . . . are given absolute protection from freeze-up with "Prestone" anti-freeze.

## **IF YOU CAN'T GET "PRESTONE" ANTI-FREEZE**

*Remember this*

In addition to the demands made on "Prestone" anti-freeze, thousands of tons of raw materials necessary for its manufacture are now being used in making vital defense equipment of many different kinds. Some of the uses to which these raw materials are being put were born in the laboratory but a short time ago.

Despite these heavy defense requirements, quantities of "Prestone" anti-freeze are still available to American motorists. But we suggest that you buy without delay. The supply may not be sufficient to meet all civilian needs.



**NATIONAL CARBON COMPANY, INC.**  
*Unit of Union Carbide and Carbon Corporation*



The word "Prestone" is a registered trade-mark of National Carbon Company, Inc.

**\$2.65**  
**PER GALLON**



**DOES NOT BOIL AWAY  
PREVENTS RUST**

# WHY ENVY THEM LONGER?

*... for now you can have the famous Harvard Classics for only 50 cents a week... actually  $\frac{1}{3}$  the cost of popular fiction!*

**M**AYBE you didn't go to college. Maybe you *did*, but missed the courses that give cultural background. *In either case, this announcement is of vital importance to you!* Time after time you have wished you could fill this gap in your education, could gain the knowledge necessary to business and social success. *Now your wish can be fulfilled!*

## LIBERAL EDUCATION AT YOUR FINGERTIPS

Dr. Charles W. Eliot, president of Harvard University for forty years, made it a vital part of his life's work to assemble this superb library. As he himself has said, "IN THESE BOOKS ARE THE ESSENTIALS OF A LIBERAL EDUCATION." And now they can be purchased at a price within the reach of every aspiring person in America!

## THE CHANCE OF A LIFETIME

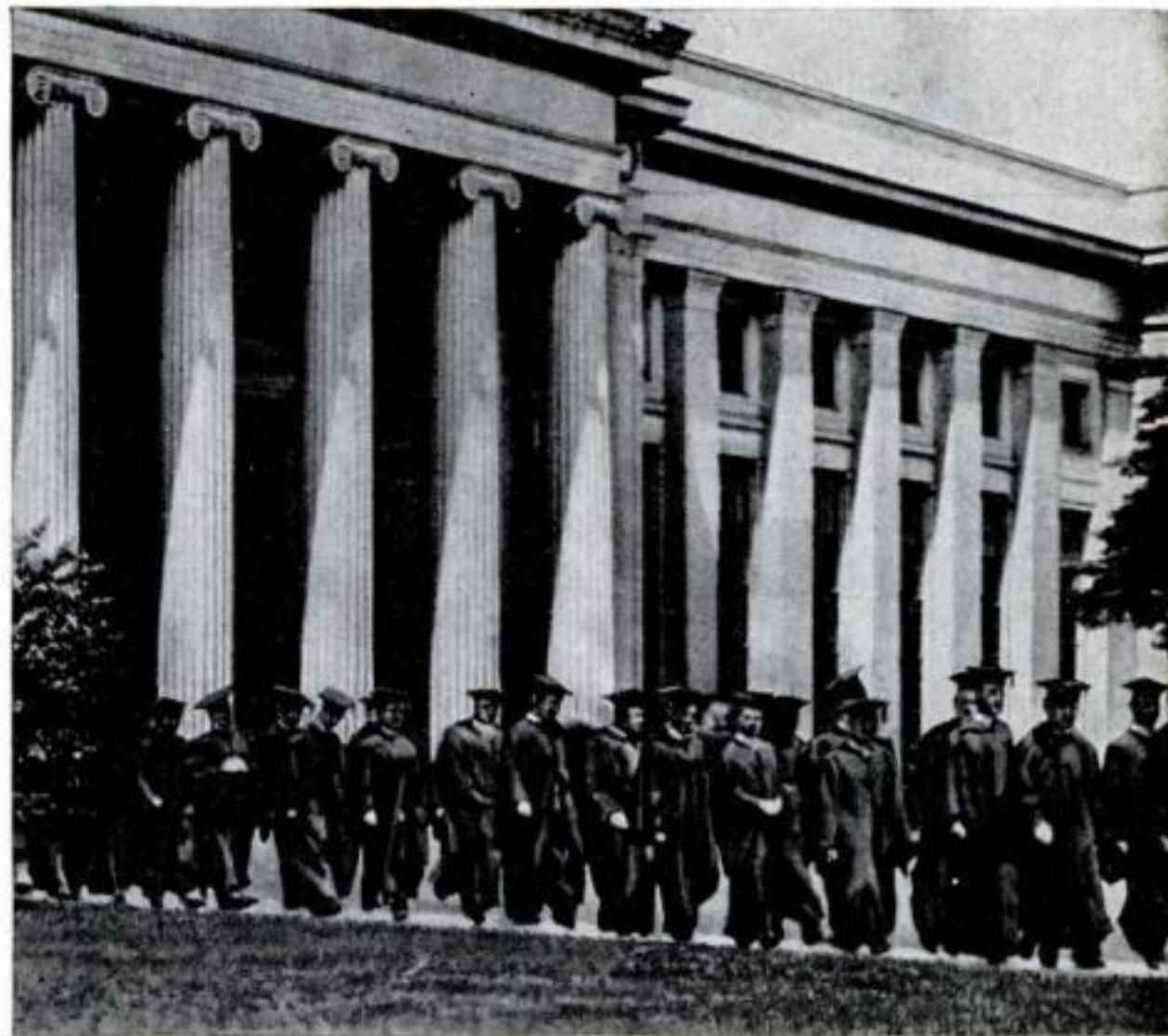
The present low price offers you the chance of a lifetime to own these famous books at a cost per volume  $\frac{1}{3}$  the price of popular fiction! Think of it! Actually, for as little as 7¢ a day, you can have this marvelous library that makes a university of your home!

## OVER HALF A MILLION SETS SOLD

Think what this means! To avail themselves of the inspiration of these masterly books, thousands have paid far more than our present price and they have been repaid a hundredfold in dividends represented by mental and cultural development and material advancement.

## A SUPERB BOOK BARGAIN!

Brentano's, one of the largest firms of retail booksellers in the world, recently stated that FOR ONLY THE PARTIAL CONTENTS OF THE HARVARD CLASSICS IN ORDINARY CLOTH-BOUND EDITIONS, THE COST WOULD BE \$402.00! Yet you can have this marvelous set, beautifully printed, handsomely and uniformly bound, for a small fraction of that cost!



*Dr. Charles W. Eliot said: "In these books are the essentials of a liberal education."*

## CONTENTS COMPLETE, INCLUSIVE

This handsome edition contains the complete contents of DR. ELIOT'S FIVE-FOOT SHELF OF BOOKS! Every word, every line, every paragraph is here! You get the same beautiful type, the same high quality paper, the same illustrations used in the costlier sets! Fifty volumes, 22,407 pages of superb reading, 418 of the world's masterpieces, the famous Lecture Volume, the Daily Reading Guide—and the unique Index of 76,000 entries that gives you the key to this vast storehouse of knowledge! All at a cost per volume  $\frac{1}{3}$  the price of a current popular novel!

## ONLY \$2.00 DOWN, 50 CENTS A WEEK

Not only is the new price of these famous books extremely low, but you have the advantage of unusually liberal terms. For an initial payment as low as \$2.00 you may have this luxurious edition placed in your home with all shipping charges prepaid by us!

**BUT YOU MUST NOT DELAY!** THE COST OF MANUFACTURING MATERIALS IS RISING RAPIDLY, SO THESE PRICES MAY HOLD FOR ONLY A LIMITED TIME. THEREFORE, WE URGE YOU TO ACT AT ONCE!

## THIS BEAUTIFUL BOOK FREE

The famous little book, "Fifteen Minutes a Day", furnishes you with full information about The Harvard Classics.

It gives Dr. Eliot's own plan of reading—is packed with helpful, practical information! It also contains dramatic biographies of men whose immortal writings appear in The Harvard Classics. This book is beautifully illustrated and is a gem of literature. It is a welcome addition to any library. It will be sent you free, postpaid and without obligation. Simply fill out and mail the coupon below.

## DR. ELIOT'S FIVE-FOOT SHELF OF BOOKS (THE HARVARD CLASSICS)



THIS COUPON ENTITLES  
YOU TO FREE BOOKLET  
(For Adults Only)

P.F. COLLIER & SON CORP.  
The World's Largest  
Subscription Booksellers  
250 Park Avenue,  
New York City HC-694

Yes! I am interested in  
receiving by mail, free  
and without obligation, your valuable  
booklet, "Fifteen Minutes a Day", de-  
scribing the famous library, Dr. Eliot's  
Five-Foot Shelf of Books (The Har-  
vard Classics) and containing Dr.  
Eliot's own plan of constructive reading.

Mr. \_\_\_\_\_  
Name Mrs. \_\_\_\_\_  
Miss \_\_\_\_\_  
Address. ....

## CONTENTS for DECEMBER, 1941

### News

Electro-Coating .....	49
Night Watchmen of the Skies.....	52
Lightweight Champion of the Metals	59
More Minutes for Working Hours.....	64
Falcons—Feathered Hunters for Man	70
Tanks Can Be Destroyed.....	75
Modern Troop Transports.....	81
Cheaper Power for Defense.....	89
Annapolis Speeds Up.....	92
Can America Build Enough Airports? 102	
Army's Smoke Throwers.....	113
Making a Surf Rod.....	116

### Automobiles

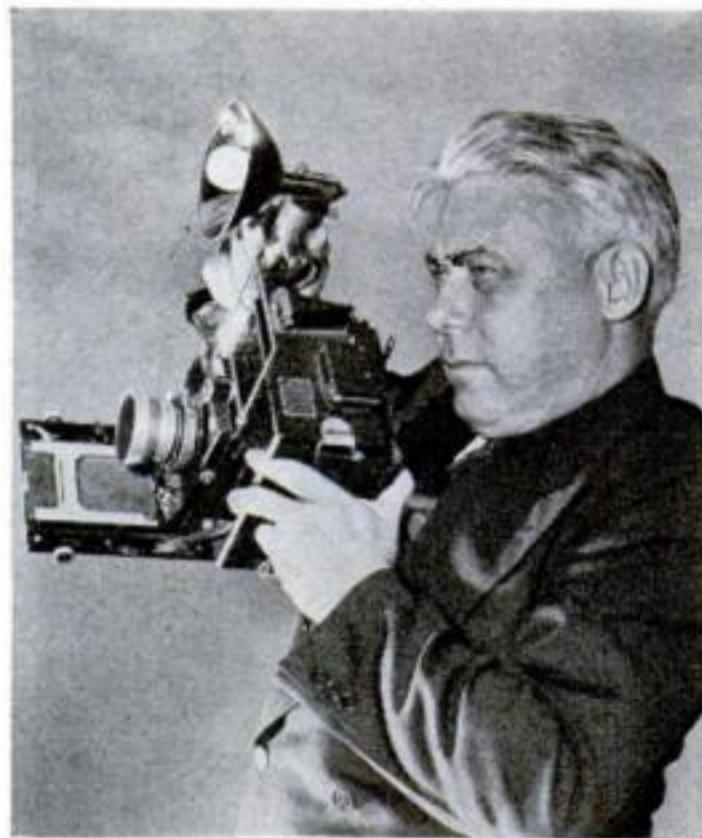
Modern Lubrication for Cars.....	130
How to Save Gas.....	134
Twelve Common Driving Faults.....	136
Army Enlarges Its Auto School.....	138
Gus Wilson's Model Garage.....	142

### Home and Workshop

Cape Cod House Wins Third Prize.....	146
Outdoor Christmas Decorations.....	156
Handsaws and How to Use Them.....	167
Knitting Boxes Make Timely Gifts.....	178
Adjustable Tester for Armatures.....	193
FM Radio Can Be Built for \$22.....	202
Good Portraits Must Be Planned.....	206

### Departments

Our Readers Say—.....	14
Here's My Story.....	96
Question Bee .....	100
Un-Natural History .....	101
Book Reviews .....	128
Radio Department .....	200
With the Inventors.....	232

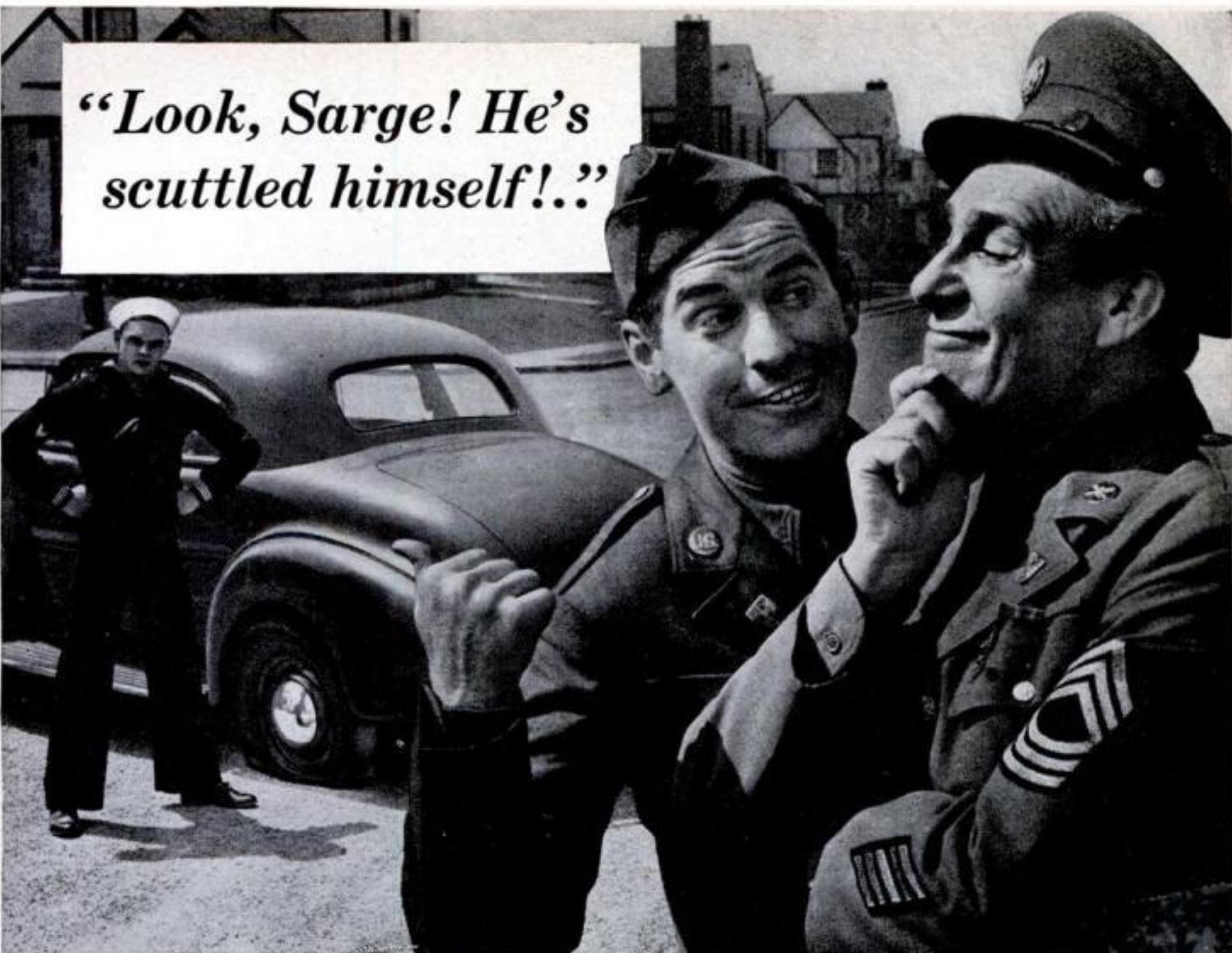


WILLIAM MORRIS got acquainted with a camera in the U. S. Navy, winding up as chief photographer for the Bureau of Navigation. Back in civil life, he managed stores for one of New York's biggest camera-supply houses. Then the World's Fair got him as chief in charge of photography for the press division. His hobby? Photography!

EDITOR . . . . . Charles McLendon  
 MANAGING EDITOR . . George H. Waltz, Jr.  
 HOME & WORKSHOP EDITOR Arthur Wakeling  
 ASSOCIATES: Carsten Grande, Art Editor;  
 Fred O. Newman, News; William Morris,  
 Photography; Schuyler Van Duyne, Automobiles;  
 Alden P. Armagnac, Edwin Teale,  
 David M. Stearns, Harry Walton, Group Editors;  
 B. T. Richards, Copy Editor; Michele  
 de Santis, Harry Samuels, Stewart Rouse,  
 Michael Cerniello, Art Assistants.

Published monthly at 353 Fourth Avenue, New York, N. Y., by Popular Science Publishing Co., Inc. Godfrey Hammond, President and Treasurer; R. C. Wilson, Raymond J. Brown, Vice Presidents; F. W. Briggs, Secretary. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada. Printed in U.S.A. Copyright, 1941, by Popular Science Publishing Co., Inc. All rights reserved in the United States, Great Britain, and in all countries participating in the International Copyright Convention and the Pan American Copyright Convention. Single copy, 15 cents; Canada, 20 cents. Yearly subscriptions to United States and its possessions, \$1.50; Canada, \$2.00; foreign countries, excepting Canada, \$2.50. Subscribers must notify us of change of address four weeks in advance of the next publication date. Be sure to give both old and new address.

**"Look, Sarge! He's scuttled himself!..."**



**SERGEANT:** Now ain't that just too bad! Think we ought to give him a hand?

**CORPORAL:** Naw! That's too strenuous. Let's just give him some good advice.

**SERGEANT:** Like "Switch to B. F. Goodrich"?

**CORPORAL:** Yeah. But come on. First thing you know he'll be getting annoyed!

**I**N times like these, most people stick to the things that are tried and true. In tires this means Silvertowns. And because Uncle Sam is using Silvertowns by thousands for defense, they're made even better than ever. You get the benefit—extra mileage—greater safety.

Remember—every single

Silvertown is made with Duramin. And Duramin is the big reason for Silvertown's outstanding mileage.

You can still buy Silvertowns at low prices. And you can still pay as you ride. All B. F. Goodrich Silvertown Stores, and many Goodrich dealers, offer the budget plan.



**All SILVERTOWNS made with DURAMIN**

(Left) **SAFETY SILVERTOWN.** Top quality. Hi-Flex cords make it stronger than ever.

(Center) **DELUXE SILVERTOWN.** The best combination of mileage, safety, comfort, and quiet.

(Right) **LIFE-SAVER SILVERTOWN.** No tire can stop you quicker, or keep you safer from skids.



The Shellcraft's outer bowl is imported briar, sandblasted. The softer parts of the briar have been blown away—the *hard* graining remains, standing out in bold relief. This heat and sand treatment increases the natural porosity of the briar, reduces the weight of the pipe. Then this unusually porous, rugged outer bowl is fitted with an inner bowl of fine Meerschaum, one of the coolest and lightest smoking materials known to pipe making. Result: your Shellcraft Kaywoodie is extraordinarily light in weight—and cool smoking from the first puff.



**KAYWOODIE COMPANY**

New York and London

[ In New York  
630 Fifth Ave. ]

© 1941, KAYWOODIE CO.

# Contents

[CONTINUED]

## Automobiles

- Troop Truck and Trailer..... 108
- Filling-Station Map Aids Drivers... 135
- Sealer Stops Windshield Leaks..... 135
- Tester Ends Gasoline Waste..... 135
- Scraper for Ice and Frost..... 141
- Preventing Loss of Filler Caps..... 141
- A Dashboard Pipe Bumper..... 141
- Making a Baby-Bottle Warmer..... 141

## Aviation

- Portable Phones for Aircraft Makers 99
- War Planes Get Tandem Propellers 111
- Cockpit Armor Protects Pilot..... 128

## Inventions

- Versatile Camera Boom..... 58
- Handy Switchboard for Movie Lights 63
- Gun Shoots Even Coating of Glue... 63
- Lighting with Paint..... 86
- "Taxi" for Bombs Aids Police..... 88
- Rescue Belt for Firemen..... 88
- Manufacturing Quiet for Movies.... 98
- Adjustable Bird-House Bracket.... 99
- Metal That Mends Bones..... 120
- Vibrating Tool Engraves and Carves 124
- Midget Tools for Cramped Spaces.. 124
- Direct-Reading Caliper ..... 124
- Center Punch Drives Itself..... 124
- Portable Cableway Bridges Streams. 125

(Continued on page 6)

IMPORTANT NOTICE: The contents of this magazine must not be reprinted without permission. The editors are not responsible for unsolicited contributions, and cannot guarantee the return of such material or insure against its loss. Contributions not accompanied by sufficient postage will not be returned. In presenting numerous stories of new products of applied science, Popular Science Monthly does not underwrite the business methods of the individuals or concerns producing them. To avoid liability for patent infringement, readers should investigate before making, using, or offering for sale any of the devices, machines, or processes described; Popular Science Monthly takes no responsibility. The use of Popular Science Monthly articles for stock-selling schemes is never authorized.

**Model Builders Attention!**

	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3 1/2	2 1/2

Actual Size V-Plug

Champion has designed 3 spark plugs for model gas engines which give the same dependable performance as regular Champions. Sillimanite sealed. Sillimanite insulator. Alloy needlepoint

electrodes for easy starting. One piece construction.

**CHAMPION**  
SPARK PLUG CO.  
901 Upton Ave.  
Toledo • Ohio

# Old Plugs INVITE TROUBLE!



## Ward Off Winter Driving Ills—Help Conserve Gasoline —with new CHAMPION SPARK PLUGS

Here's quick relief from the paralyzing effects of cold weather on cars using old, worn-out, inferior quality spark plugs—new Champion Spark Plugs!

Old plugs—spark plugs that have been in service 10,000 miles or more—invite trouble. Carbon encrusted insulators, burned electrodes and compression leakage rob all spark plugs of their efficiency. This results in hard starting, run-down batteries, poor acceleration and loss of power and speed. Economy of operation disappears. A new set of Champions will ward off these winter driving ills, and give you that imperative *extra* gas mileage required by our national gasoline economy program.

HERE'S THE CHAMPION SPARK PLUG FOR YOUR CAR

MODEL	YEAR				
	'37	'38	'39	'40	'41
A. BANT.	C7	J8	H10	H10	H10
BUICK	15	J5	J5	10 MM 14 MM	T4A J5
CAD. ILLAC	8 cyl. J8 Others 7		T4A	T4A	T4A
CHEV. ROLET	J8	J8	J8	J8	Y5
CHRY. SLER	Reg. Hds. J8 Alum. Hi. Hds. H10		J9	J9	
DE SOTO	Reg. Hds. J8 Alum. Hi. Hds. H10		J9	J9	

MODEL	YEAR				
	'37	'38	'39	'40	'41
DODGE	Reg. Hds. J8	J9	J9		
	Alum. Hi. Hds. H10				
Models A & B, C4					
FORD	Big V8 18Mm.				
	7	7		All	H9
	14 mm. H10			Mod.	Cam.
	60 HP			H10	or
	H10	H10			H10
GRA-HAM	7	H10			
	Supercharged		H10	J10	Com.
	& 95 Ser.				
	H10				

MODEL	YEAR				
	'37	'38	'39	'40	'41
HUDSON	All Reg. Hds. J9				
HUPP.	All Hi. Hds. H10				
LA FAY.	7	7	7	7	7
LA SALLE	JB	JB	Y1A	Y1A	
LINCOLN	7	7	7	H10	H9Cam or H10
MER-CURY			H10	H10	H9Cam or H10
NASH	JB	JB	JB	J9	H9Cam
OLDS.	JB	JB	JB	J9	J9
PACKARD	Y4	Y4	Y4	Y4	Y4A

MODEL	YEAR				
	'37	'38	'39	'40	'41
PLYM- OUTH	Reg. Hds. JB		J9		J9
		Allum.	Hi.	Hds.	H10
PONTIAC	J8	J8	J8	J9	J9
STUDE- BAKER	All Reg.	Hds.	8		Cham. JB
		Hi.	Hds.	7	Comm. 8
					Pres. 8
TERRA- PLANE	All Reg.	Hds.	JB		
		Hi.	Hds.	H10	
WILLYS 4, 6 & 8	C7	C7	J8	Reg. Hds. J9	
				Hi. Hd. H10	
ZEPHYR	All Models	H10		H5Com	
				or H10	

YOUR CAR MAY REQUIRE A HOTTER OR COLDER TYPE THAN NORMALLY RECOMMENDED—IF IN DOUBT CONSULT YOUR DEALER

# There's a Preparedness Problem *in your home too!*



An Underwood Portable will help prepare youngsters for graduation now...and for business later.

This Underwood Champion Portable is particularly smart in its modern design and finish . . . and comes in a trim lightweight carrying case. Just what a youngster needs for homework—what the whole family needs for *all* writing tasks. And it's made by the makers of all the *big* Underwoods of business and equipped with 15 big Underwood features. Don't be satisfied with an ordinary portable—insist upon a *complete* Underwood.

See your nearest **UNDERWOOD DEALER** or mail coupon for full information.

## Underwood

### Portable Typewriter

Portable Typewriter Division  
**UNDERWOOD ELLIOTT FISHER COMPANY**  
One Park Avenue, New York, N. Y.

Please send free folder "Things to Seek in the Portable You Buy". It contains full information concerning the Underwood Champion Portable.

Name.....

Address.....

P. S. M. 12-'41

City..... State.....

Copyright 1941, Underwood Elliott Fisher Company

# Contents

[CONTINUED]

## Craftwork

South American Vaquero Penholder	164
Jolly Santa Claus Centerpiece.....	164
Latticework Paper-Napkin Holder..	176
Wood-and-Copper Table Tidier.....	180
Table-Tennis Paddle Press.....	180
Graceful Scroll Candleholders.....	182
Black-Walnut Earring Ornaments...	182
Model Railway "Through Station" ..	184
Realistic Trackside Lumber Shed...	185
Hints for Model-Plane Builders....	186

## Home Building

Cape Cod House Wins Third Prize..	146
Winners Submitted 20 Drawings....	154
Outdoor Christmas Decorations....	156
Weeding Turned into a Game.....	160
Insect Killer and Deodorizer.....	160
Light for Outside Thermometer....	160
Flexible Steel Plaster Knife.....	160
Ready-Mixed Concrete Patcher....	161
Refinishing Without Sanding.....	161
Painting Over New Plaster.....	161

## Miscellaneous

Cardboard Improves Coat Hanger...	162
Simple Cleaning of Upholstery.....	162
Taped Ashtrays Won't Mar Table...	162
Stocking Improves Rolling Pin.....	162
Making Window Sockets Visible....	163
Glue Used to Seal Its Own Can.....	163
Glass-Mirror Edging for Shelves....	172
Cans That Heat Themselves.....	172
Accurate Modern Kitchen Scales....	172
Adjustable Clothes-Closet Rod.....	172
Headlight Guides Electric Iron.....	173
Insuring Privacy of Windows.....	173
Self-Sharpening Paring Knife.....	173
Venetian Blind Cleaning Kit.....	173
Kitchen-Table Chemistry Tests.....	197

## New Shop Ideas

Homemade Drafting Machine.....	187
Cans Catch Grinding-Wheel Grit....	189
Making a Set of Lathe Mandrels....	190
Constructing a Surface Gauge.....	190
Weights Stop Vibration in Lathe....	192
High-Speed Ball-Bearing Spindle....	192
"Growler" for Testing Armatures...	193

(Continued on page 8)

Together we'll make the U. S.  
invincible

Because we're both getting  
**MODERN TRAINING!**



YES, America is building two great modern armies: an army of trained soldiers, and an army of trained workers!

*You belong in one of them!* Today, the man who neglects his training neglects not only his own welfare—but his country's! Start now to modernize your training—make yourself a more valuable citizen, eligible for the bigger, better paying jobs in business and industry!

An I. C. S. Course in your line of work costs only a few dollars monthly. Study at home, in your spare time. Day by day, you'll find yourself better prepared for *real success* in your field. Mail coupon immediately, for full details on courses and costs.

**INTERNATIONAL CORRESPONDENCE SCHOOLS**

CELEBRATE 50 YEARS OF SERVICE TO AMBITIOUS AMERICANS

1891-1941

BOX 7621-K, SCRANTON, PENNA.

★ Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the course *before* which I have marked X: ★

**TECHNICAL AND INDUSTRIAL COURSES**

- Agriculture       Air Brake
- Air Conditioning
- Airplane Drafting
- Architectural Drafting
- Architecture
- Auto Engine Tune-up
- Auto Technician
- Aviation       Aviation Mechanic
- Boilermaking
- Bridge Engineering
- Chemistry
- Civil Engineering
- Coal Mining
- Concrete Engineering

- Accounting       Advertising
- Bookkeeping
- Business Correspondence
- Business Management
- Cartooning       Civil Service

- Advanced Dressmaking
- Foods and Cookery

- Contracting and Building
- Cotton Manufacturing
- Diesel Engines
- Electrical Drafting
- Electrical Engineering
- Electric Lighting
- Foundry Work       Heating
- Heat Treatment of Metals
- Highway Engineering
- House Planning
- Locomotive Engineer
- Machinist
- Management of Inventions
- Mfg. of Pulp and Paper

- College Preparatory
- Commercial
- Cost Accounting
- C. P. Accounting
- First Year College

- Home Dressmaking
- Professional Dressmaking and Designing

**HOME ECONOMICS COURSES**

- Marine Engines
- Mechanical Drafting
- Mechanical Engineering
- Mine Foreman
- Navigation
- Patternmaking
- Pharmacy       Plumbing
- Poultry Farming
- Practical Telephony
- Public Works Engineering
- Radio, General
- Radio Operating
- Radio Servicing
- R. R. Section Foreman

- Foremanship       French
- Good English
- High School
- Illustrating
- Managing Men at Work

- R. R. Signalman       Refrigeration
- Sanitary Engineering
- Sheet Metal Work
- Ship Drafting       Shop Practice
- Steam Electric       Steam Engines
- Steam Fitting
- Structural Drafting
- Structural Engineering
- Surveying and Mapping
- Telegraph Engineering
- Telephone Work
- Textile Designing       Toolmaking
- Welding, Electric and Gas
- Woolen Manufacturing

- Railway Postal Clerk
- Salesmanship
- Secretarial
- Showcard and Sign Lettering
- Traffic Management

- Tea Room and Cafeteria Management, Catering

Name..... Age..... Address.....

City..... State..... Present Position.....

Canadian residents send coupon to International Correspondence Schools Canadian, Limited, Montreal, Canada  
British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England

## How to "antique" a piece of furniture



● A Carborundum Brand Garnet Abrasive Sleeve fitted to a drum rotated by a flexible shaft becomes sometimes more useful than a disc sander.

For instance, in making antique furniture reproductions you will find a sanding drum a big time saver. It can be used to make almost any kind of depression in any wood. Edges and corners are easily rounded to simulate wear. And high-lighting the work after staining is a simple matter.

## Furniture factories use abrasive sleeves, too!



● Modern furniture factories use Carborundum Brand Coated Abrasive Sleeves to cut time and costs on a wide variety of sanding jobs. These sleeves have the identical high quality of the Carborundum Brand Abrasive Products that save time, labor and money in your home workshop. Send us 10¢ for 95 page illustrated manual on home craftsmanship, and we'll include a souvenir sharpening stone.

**CARBORUNDUM**  
Abrasives Products

Write Dept. S-121

**THE CARBORUNDUM COMPANY**,  
REG. U. S. PAT. OFF.

*Niagara Falls, N. Y.*

Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company

# Contents

[CONTINUED]

## Photography

Good Portraits Must Be Planned....	206
Photo Patterns Without a Camera...	210
Automatic Diaphragm on Graflex....	211
New Mount for Color Films.....	211
Hollywood Cameras' Kid Brother...	212
Movies Gain in Depth of Focus....	213
Turntable for Trick Movie Titles...	214
Ink Spot Helps Focus Enlarger....	214
Print Washer Flushes Itself.....	215
Projector Strip and File.....	216
Grooved Mat for Film Holders.....	216
Papers Aid in Weighing Chemicals..	216

## Radio

Powerful Radio on Tiny Island....	58
Analyzer Tests Audience Reaction..	112
Heat Safeguards Radio Beacons....	122
Arm Plays Both Sides of Record....	200
Painted Hammer-Metal Effect.....	200
Microphone for Long Distances....	200
Portable Set Uses House Current...	201
German Plane Radio Below Par.....	201
Corner-Post Antennas for Autos....	201
Midget Tubes on Broadcast Band...	201
FM Receiver Built for \$22.....	202

## Shop Data File

Mortise-and-Tenon Joints .....	168
Leather Craft—Embossing .....	177
Acme Screw Threads and Formula..	189

## The Handy Man

Wrench Is Help in Pulling Nails....	162
Hooks Secure Clothesline Pole.....	162
Automatic Dry-Cell Closet Light...	163
Household Sprayer Applies Sizing...	163
Hook on Ladder Holds Paint Pail...	163
Stovepipe Crimped at Joint.....	163

## Woodworking

Band-Sawed Regency Flower Stand..	166
Handsaws and How to Use Them....	167
Spirally Fluted Wooden Vases.....	174
Folding Kitchen Towel Rack.....	177
Knitting Boxes Make Timely Gifts..	178
Ball-Bearing Knitting-Yarn Reel...	183



# THOUSANDS OF MEN ARE NOW PUSHING YOU UP TO PROMOTION AND HIGHER PAY

NEVER before have you faced the opportunity you have today.

Millions of men are going to work in expanded plants and offices, in new industries. They must have supervision; there will be thousands of new supervisory and executive jobs. Authorities agree that there is a shortage of men for these advanced jobs.

The industries haven't time to train all these executives—they must locate many men already prepared and capable. That means you—if you are ready or will get ready quickly.

These supervisory jobs will be of every kind—office, plant, accounting, traffic, legal, secretarial—they will occur everywhere. They will be in new defense plants, in plants expanded to handle defense orders, and in ordinary product plants (because many men will go from these to the defense plants or into military service).

Obviously, too, this demand will continue and grow for some time to come.

The men who act most quickly will get the most advantage from this unparalleled opportunity. They will be shoved up most quickly and farthest.

LaSalle training fits this situation exactly. It is supervisory, executive training. It is condensed, practical; you study methods and apply them to typical business problems. It is spare-time training—take it as fast as your time permits. You need not wait until you have finished it—what you study tonight, you can use on the job tomorrow. Employers know of LaSalle training—welcome the LaSalle trained men.

You must act quickly. Ask for our 48-page, free booklet on the field in which you are interested. It describes the field, its opportunities and its demands and tells how our training fits you for the field. Send the coupon today.

## LASALLE EXTENSION UNIVERSITY A CORRESPONDENCE INSTITUTION Dept. 1283-R CHICAGO

I want to prepare for one of those advanced jobs created by the present situation. As a first step, I must get full information. Please send me your free 48-page booklet on the field I have checked below.

- Industrial Management
- Executive Management
- Traffic Management
- Business Correspondence

- Foremanship
- Salesmanship
- Business Law
- Law

- Accounting
- Bookkeeping
- C. P. A. Coaching
- Business English

Name \_\_\_\_\_

Age \_\_\_\_\_

Address \_\_\_\_\_

Present Position \_\_\_\_\_



KNOWLEDGE  
THAT HAS  
ENDURED WITH  
THE PYRAMIDS



## A SECRET METHOD FOR THE MASTERY OF LIFE

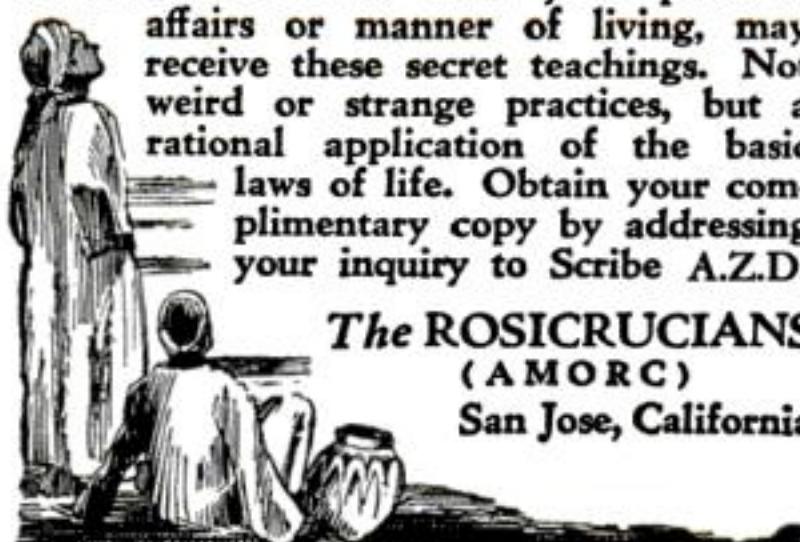
WHENCE came the knowledge that built the Pyramids? Where did the first builders in the Nile Valley acquire their astounding wisdom that started man on his upward climb? Did their knowledge come from a race now submerged beneath the sea? From what concealed source came the wisdom that produced such characters as Amenhotep IV, Leonardo da Vinci, Isaac Newton, and a host of others?

Today it is known that they discovered and used certain *Secret Methods* for the development of their inner power of mind. They truly learned to master life. This secret art of living has been preserved and handed down throughout the ages and to-day is extended to those who dare use its profound principles to meet and solve the problems of life in these complex times.

### This Sealed Book — FREE

Has life brought you that personal satisfaction, the sense of achievement and happiness that you desire? If not, it is your duty to yourself to learn about this rational method of applying natural laws for the mastery of life. To the thoughtful person it is obvious that everyone cannot be entrusted with an intimate knowledge of the mysteries of life, for everyone is not capable of properly using it. But if you are one of those possessed of a true desire to forge ahead and wish to make use of the subtle influences of life, the Rosicrucians (not a religious organization) will send you A Sealed Book of explanation without obligation. This Sealed Book tells how you, in the privacy of your own home, without interference with your personal affairs or manner of living, may receive these secret teachings. Not weird or strange practices, but a rational application of the basic laws of life. Obtain your complimentary copy by addressing your inquiry to Scribe A.Z.D.

**The ROSICRUCIANS  
(A M O R C)**  
San Jose, California



## Coming Next Month —

DRIVING AT NIGHT is three times as dangerous as driving by day. Statistics show that for every mile you travel after darkness has fallen, your risk of a fatal accident is threefold. In an article based on facts and figures, Myron M. Stearns analyzes the special hazards of night driving and gives common-sense advice for avoiding them. Safety rules and charts enable you to check your own night driving.

NO SOAP—but a chemical cleanser that does lots of things better than soap and some things that soap can't do at all. That's TSP (trisodium phosphate), a white powder that has many important uses in industry. When you read about its amazing powers, you'll want to put it to work in your home, too.

WELDING has been coming into its own lately, with increased use in shipbuilding and many other fields. But nobody has carried it farther than R. G. LeTourneau, inventor and builder of mammoth earth-moving machinery. How this engineering wizard uses welding in his business and private life (even the mantel in his home is welded) makes an interesting story as told by Hickman Powell.

AN SOS FROM AN ARMY CAMP, asking for plans for building recreation-room furniture, is the inspiration of an article by Joseph Aronson, noted interior decorator. His designs for sturdy, easily made settees and tables will be of interest not only to men in camp but also to clubs, outdoor organizations, and owners of game rooms and summer cottages.

SOUPS IN POWDER FORM, vegetables in dry flakes—these are among the new wonders being produced by the dehydration of foods. By removing water, this process reduces bulk and weight, thus cutting transportation costs and offering new convenience to sportsmen and housewives. It also figures in defense and in plans for feeding Europe after the war. Read about it in the January issue.

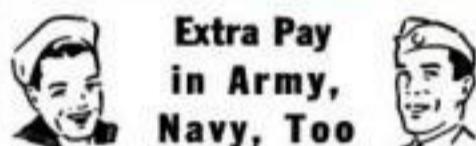
CASEY JUNIOR is a locomotive—no sleek streamliner, but an engine with a personality. You'll enjoy making him from plans in the January issue, and any kid will enjoy pulling him around on the floor. For good measure, you get plans for circus cars to go with him, and a model of a circus in winter quarters, all resembling "props" in Walt Disney's new feature-length picture "Dumbo."

# WANTED

## Men Anxious To Make \$30 \$40 \$50 a Week



RADIO TECHNICIANS HOLD GOOD JOBS in more than 800 Broadcasting stations in the U. S. with average pay among the country's best paid industries. Aviation, Police, Commercial Radio are other fields which employ Radio Technicians and Operators. I give you the Radio training you need for jobs like these, and train you to be ready when Television opens new jobs in the future. Get the facts. Mail the Coupon.



Every man likely to go into military service, every soldier, sailor, marine, should mail the Coupon Now! Learning Radio helps men get extra rank, extra prestige, more interesting duty at pay up to 6 times a private's base pay. Also prepares for good Radio jobs after service ends. IT'S SMART TO TRAIN FOR RADIO NOW. Mail the coupon.



REPAIRING, SERVICING, SELLING home and Auto Radio sets (there are more than 50,000,000 in use) gives good jobs to thousands. Public Address Systems are another source of profit for Radio Technicians. Many Radio Technicians operate their own spare time or full time Radio business. Mail the Coupon.

### N. R. I. Trained These Men At Home



#### Chief Operator Broadcasting Station

Before I completed your lessons, I obtained my Radio Broadcast Operator's license and immediately joined Station WMPC where I am now Chief Operator.—Hollis F. Hayes, 327 Madison St., Lapeer, Mich.



#### Now Chief Radio Engineer

I am now Chief Radio Engineer at Kankakee Ordnance Works and very pleased with my new position. If I had not taken the N. R. I. Course I might be digging ditches or perhaps unemployed.—R. S. LEWIS, 410 Whitney St., Joliet, Ill.



#### Had Own Business 6 Months After Enrolling

I went into business for myself 6 months after enrolling. In my Radio repair shop I do about \$300 worth of business a month. I can't tell you how valuable your Course has been to me.—A. J. Baten, Box 1168, Gladewater, Texas.

#### \$40 a Month Extra in Spare Time

I do Radio Service work in my spare time only, operating from my home, and I net about \$40 a month. I was able to start servicing Radios 3 months after enrolling with N. R. I.—Wm. J. Chermak, R. No. 1, Box 287, Hopkins, Minn.

Busy Radio Industry Increasing Demand  
For Radio Operators and Technicians

### LEARNING RADIO AT HOME NIGHTS THIS WAY HAS LANDED GOOD JOBS FOR HUNDREDS

Here is a quick way to more pay. Radio offers beginners a chance to make \$5, \$10 a week extra in spare time a few months from now, and to train for opportunities paying up to \$30, \$40, \$50 a week for full-time Radio Technicians and Operators. On top of record business, the Radio industry is getting millions of dollars worth of vital defense orders. Many Radio Technicians and Operators have entered military service, opening many opportunities for men with Radio training. Clip the coupon below and mail it. Find out how I have trained men from 16 to 50 years old to make more money in Radio—how I will train you, too, for Radio's opportunities.

#### Beginners Quickly Learn to Earn \$5 to \$10 a Week in Spare Time

Nearly every neighborhood offers opportunities for a good part-time Radio Technician to make extra money fixing Radio sets. I give you special training to show you how to start cashing in on these opportunities early. You get Radio parts and instructions for building test equipment, for conducting experiments that give you valuable practical experience. You also get my modern Professional Radio Servicing Instrument. My fifty-fifty method—half working with Radio parts, half studying my lesson texts—makes learning Radio at home interesting, fascinating, practical.

#### Mail Coupon for 64-page Book

It tells about my Course; the types of jobs in the different branches of Radio; shows letters from more than 100 men I trained so you can see what they are doing, earning. Mail the Coupon in an envelope or paste it on a penny postal.

J. E. Smith, President,  
Dept. INP3,  
National Radio Institute,  
Washington, D. C.



### FREE TO MEN WHO WANT BETTER JOBS

J. E. SMITH, President, Dept. INP3  
National Radio Institute  
Washington, D. C.

Mail me FREE without obligation, your 64-page book, "Rich Rewards in Radio." (No salesman will call. Write plainly.)

Age.....

Name.....

Address.....

City..... State.....

*From the  
news desk*

**K**EPPING THE BRAIN COOL while a raging fever surges through the rest of the body has long been a major medical problem. The value of a high fever in the treatment of cancer, for example, is well known, but human beings can rarely withstand body temperatures of more than 108.5 degrees Fahrenheit. Experiments conducted by Dr. Clarence A. Neymann, of Northwestern University, have shown, however, that a dog can withstand very high temperatures if its carotid artery, which supplies blood to the brain, is packed in dry ice. It is hoped that the same procedure may enable humans to receive greater benefits than ever before from fever therapy.

**T**HE THREATENED SHORTAGE of chlorine gas may be averted through a new process reported by two Columbia University scientists, Prof. Arthur W. Hixson and Dr. Alvin H. Tenney. Instead of using large quantities of electric current, as in the process widely used now, the only raw materials needed are sulphur and common salt, both of which are abundantly available. Dry sulphur trioxide is produced by burning sulphur in air. This gas is thoroughly infiltrated through salt. When heated, this material gives off chlorine gas. The solid residue of sodium sulphate is required in the manufacture of glass, rayon, and paper. An economical feature of the new method is that the heat produced by the burning sulphur, in the first step, is more than sufficient to heat the salt cake in the second phase.

**A** WORLD RECORD for continuous glass pouring was recently established at the Ford Motor Company's glass plant. For 904 days—almost 2½ years—there had been pouring out a 51-inch strip of glass which, laid in a straight line, would have measured 2,854 miles, or would cover an area of 1,442 acres. The previous record, 159 days, was also established at the Ford plant.

**T**HE U. S. ARMY AIR CORPS has undertaken to measure the qualities that make a first-class fighting pilot before his training is begun. Recognized leaders in psychology, stationed at three new research centers, have already begun the search for this new yardstick which, within limits, will indicate prospective flyers' courage, perception, and judgment.

**T**HE MIRROPHONE, a new magnetic sound recorder and reproducer, is said to handle higher frequencies than previous magnetic sound recorders, and to be freer from distortions. Developed by Bell Telephone Laboratories, it has already proved its worth to singers, public speakers, and instrumentalists for studying speech characteristics and sound production. A record may be kept indefinitely, or cleared immediately for a new reproduction.

# AMAZINGLY EASY WAY TO GET INTO ELECTRICITY

*I'll Finance Your Training*



## NO BOOKS NO CLASSES

No dull books, no baffling charts, no classes. You get individual training on real electrical equipment. Coyne training is tested and proven—This school is 42 years old.

## EARN WHILE LEARNING

If you need part-time work to help pay your living expenses I'll help you get it. Then, in 12 brief weeks, in the great roaring shops of Coyne, I train you as you never dreamed you could be trained...on one of the greatest outlays of electrical apparatus ever assembled, real dynamos, engines, power plants, autos, switchboards, transmitting stations... everything from doorbells to farm power and lighting... full-sized... in full operation every day!

### PREPARE FOR JOBS LIKE THESE

Armature Winder  
Sub-Station Operator  
Auto & Aviation Ignition  
Maintenance Electrician  
Service Station Owner  
Air Conditioning  
Electric Refrigeration  
Radio Servicing  
and many others

Our Employment Bureau for  
graduates gives FREE life-  
time employment service.

## Learn Without Books in 90 DAYS

Get into the fascinating, fast growing, well paid field of Electricity—a field that offers you opportunities and a future—in good times and bad times—a field that is a permanent necessity in prosperity or depression. Here is your chance to prepare yourself for a lasting permanent future.

Here at Coyne, in 90 days, you can train for your Big Opportunity by working on real electrical machinery. Here you learn airplane ignition, wind armatures, learn power plant operation, do house and factory wiring, etc. Coyne training is **easy to learn**. You "Learn-By-Doing", not by books. **Not a correspondence course**. You don't need previous experience or advanced education. With this brief description of my school I want to bring out this important fact

—you don't need much money to get my training. I have many plans to help the fellow who needs training but hasn't much money. Read all of this advertisement—then mail coupon for all the facts.

### MAIL COUPON FOR FREE BOOK

I want to tell you my complete story—how I have helped hundreds of other fellows get good-pay jobs and how I can help you. I want to send you your copy of my Big FREE Book, packed with pictures of students at work in my shops. I want to tell you about my plans to help you. You'll be particularly interested in this special EXTRA offer: **4-Weeks course in RADIO at no extra tuition charge**. Send for my complete story. No obligation. No salesmen will call. Mail coupon today.

**H. C. LEWIS, President** **COYNE ELECTRICAL SCHOOL**  
500 S. Paulina St. Dept. 91-73 CHICAGO, ILLINOIS

**H. C. Lewis, President,  
COYNE ELECTRICAL SCHOOL,  
500 S. Paulina St., Dept. 91-73, Chicago, Ill.**

Please send me your Big FREE Book and all the facts about Coyne and your plans to help fellows like me get ahead.

NAME.....

ADDRESS.....

CITY..... STATE.....



H. C. Lewis



Home of  
Coyne  
Electrical  
School



# Readers Say:

## He Should Sue Gus Mager for One Scent Damages

IF you will look back to the September 1939 issue of your magazine, you will notice in the Un-Natural History department the statement that a person cannot be scented by a skunk if he holds him by the tail. I can tell you a different story. I had one of these animals by the tail and he scented me and I have three witnesses to prove it. I have been getting your magazine for three years and I

HEY, DON'T YOU READ P.S.M.?



have found only one thing wrong in it. You can guess what.—R. A., Wilton, N. H.

## Steam Power for Small Boats Suggested as Defense Step

IN VIEW of the recent gasoline-shortage scare on the eastern seaboard, and the hints that the scare may become more real in the near future, why don't you do something to develop an interest in the use of steam as a power source for small boats? I own a small 18-footer inboard not dissimilar to some you have featured. It is a fairly common craft. While I am overpowered, ten horsepower usually is ample for this kind of boat. A coal, coke, or wood-fired boiler and a small single or two-cylinder steam engine ought to drive her adequately. But there has been no information on steam engines for many years. What has happened to the old Stanley Steamers, the Doble-Detroits, the White Steamers? Their engines might be available somewhere. And boilers—maybe they could be built as flash boilers using alcohol under pressure or

HOT DIGGETY!



something similar. Boats have their defense uses, but gasoline is limited. P. S. M. could be doing a patriotic act in awakening the boating fraternity to the older methods of propulsion.—E. T. S., Washington, D. C.

## The Movie Projectionist— as Seen from the Audience

THAT was an interesting letter by J. A. W., telling how movie projectionists pass the time by watching for technical flaws in the picture. However, I don't believe that many of them pay much attention to the screen. Sitting in the audience, I notice that they can beat any Hollywood film editor in making mistakes—which mostly result from the operator's not watching the screen. Here are a few of the mistakes I have seen in my 16 years of movie-going (I am 16): At the start of the show, the sound track pops on and runs for a long time before the lights go out (if they do at all). Then the newsreel is slid on with the picture cut in half; the operator hears violent whistling, looks out the window, and centers the film correctly. At the change-over, he turns the second projector on too late and we are treated to about a half minute of labels and titles that the audience is not supposed to see. About the middle of the feature, one machine gets out of focus and as a result we watch alternate bad and good reels for the rest of the program.—G. B., Riffle, W. Va.

I CAN'T WATCH HIM  
MISTREAT HER  
LIKE THAT!



## Paraffin Fixes Leaky Windows as Well as Battery Terminals

NOTICED in Readers Say that somebody suggested candle wax for keeping car-battery terminals from corroding. My husband has used heavy grease for several years and it is most satisfactory. Smear on plenty of it. I have another true and tried suggestion: If a window stubbornly leaks, pour melted paraffin in all the cracks around it. One side of our house trailer leaked water in on my clothes because the sun had caused it to bulge and pull away from the wooden strip it was attached to. I filled the crack with paraffin and now all is O.K.—Mrs. C. W. L., Delaware, Ohio.

**THEY WHISTLE**

**THEY'RE ALL-ELECTRIC**

Built with No. 8½  
Erector Set

Built with No. 9½  
Erector Set

**THEY BUZZ WITH ACTION**

**The COLOSSAL  
ALL-ELECTRIC**

**ERECTOR**

P. S. When in New York City, visit the Gilbert Hall of Science, Fifth Avenue at 25th Street, and see the complete exhibit of Erector, American Flyer Trains, Gilbert Chemistry Sets and other Gilbert Scientific Toys.



## ALL-ELECTRIC NO. 8½ ERECTOR

Crammed with exciting electric features. Whistle. 110 Volt reversing electric engine, with automobile-type gear shift. Electric lights. Electro-magnet so powerful it grabs up steel girders before it touches them. Contains total of 15 pounds of up-to-the-minute parts for building bascule bridge, giant Ferris wheel, magnetic crane, oil drilling rig and many other whistling, engine driven, electrically lighted engineering marvels. Builds over 100 models.

**FREE**



**HELLO BOYS! Look at all the fun and action you get with my new Erectors**

It's colossal, boys . . . that towering Erector army training parachute jump. You build it yourself. Piece by piece—with your own hands—you fit the long gleaming girders together—attach the rigging for the four parachutes—and install the powerful Erector reversing electric engine . . . And now for thrilling fun. Give the action signal by blowing the Erector whistle . . . throw your engine into gear and your parachutes are hoisted up and up until they strike the release mechanism. Then, like a flash they plummet downward—unfold—and lazily float to the ground.

Now get a load of that mighty Ferris wheel. It whistles—twinkles with light—operates in either direction at slow or high speed.

You can build hundreds of spectacular, realistic mechanical marvels with one Erector set. And how the Erector electric engine makes them buzz with action! See my new All-Electric Erectors at your nearest toy store today. Take Dad along. A. C. Gilbert, President.

—big 24-page illustrated book, "Fun and Action for Boy Engineers."

Boys, getting this book is as exciting as going to the movies. Over 100 illustrations showing all of the new Erector sets and the gigantic, realistic action models they build. Mail coupon or post card.

The A. C. Gilbert Co., 607 Erector Square  
New Haven, Conn.  
Here's my name and address. Rush big book.

Name.....

Street.....

City..... State.....

Offer good only in U.S.A.

**STALLING ALL CARS! CLEAN OUT  
RADIATORS WITH SANI-FLUSH  
BEFORE ADDING ANTI-FREEZE**



A clogged radiator causes overheating. Wastes anti-freeze. Often causes expensive trouble. Don't take chances. Sani-Flush cleans out automobile radiators for 10c. (25c for the largest truck or tractor.)

Do the job yourself—or have your service station do it. Plain water isn't enough. Insist on Sani-Flush. Can't harm aluminum cylinder heads. It's used in most bathrooms for cleaning toilet bowls. (Directions on can.) Sold by grocery, drug, hardware and 5-and-10c stores. 10c and 25c sizes. The Hygienic Products Co., Canton, Ohio.

**Sani-Flush**  
CLEANS OUT RADIATORS

**Readers Say:**

**Remember Now, Fellows—  
Only OLD Alarm Clocks!**

E. J., of BROOKLYN, N. Y., wants to know what to do with broken alarm clocks. For ten years (since the age of six), I've been taking apart old alarm clocks and have put them to good use in at least four or five different ways. If you have a youngster in the house, he would be tickled if you made him a present of the delicately balanced pendulum wheel for a spinner—or, if you wish, you can make him a small gyroscope with it. The hairspring attached to it should be removed carefully and saved, for there are many times around the shop when its delicate tension comes in handy. The gear ratios provided by the time and alarm mechanisms are also very useful. For instance, at present I am building a model three-way derrick, using two toy building-set motors and the gear mechanism from a large alarm clock. The alarm mechanism is used to gear down the control for the block and tackle, and the time mechanism gears down the control for lifting and lowering the crane. (The swivel is operated by a worm gear from the building set.) This use of course necessitates the removal of the heavy springs, which are useful for heavy-tension jobs around the shop. Now will someone please suggest a simple way of getting a dozen separate electrical contacts into a swiveling cab whose turning diameter is six inches?—J. W. W., New York City.



**Lots of Things Can Cause  
Excessive Oil Use**

THE average motorist thinks of a ring job when oil use becomes excessive. However, defective rings are only one of many causes of engine-oil waste. I wish you would have an article in your magazine about this soon.—O.B., Boston, Mass.

*O.B. may find something of interest on page 130.*

TOO MUCH OIL DOES  
MEAN A RING JOB!



**BIG MONEY Assembling  
NEW MEAD KI-YAK**

at  
Home!

MEAD'S  
complete  
cut-to-fit  
KI-YAK  
Kite easily  
assem-  
bled for  
pleasure

or profit! Portable, Seaworthy. Light . . . Fast. Highest quality. Low cost. 3 models 20 lbs. to 45 open a new world of sport for you both in sailing, paddling. Also 2 portable Outboard Models. Finished double-blade paddle or Oars now INCLUDED with your KI-YAK. Write now for illustrated circulars, low Factory-to-You prices!

**WRITE**  
for big  
illustrated  
**FREE**  
Circulars!

**MEAD GLIDERS, 15 S. Market, Dept. D-121, Chicago**

# America Can't Wait Industry needs you NOW

## Defense Program Needs Trained Men

There is a tremendous shortage of skilled men in almost all branches of industry. Draftsmen, electricians, machine designers, machinists, are wanted for good jobs at fine pay. Executives too; foremen, superintendents, managers, are needed right now to handle the enormous demand for finished products of all kinds. If you are already in one of these fields, you owe it to your country, to your family, and to yourself to make yourself even more valuable, to climb and climb fast and help put through the most important program we have ever had to face.

### Opportunities Everywhere

Home building, ship building, manufacturing plants, great utility projects, road building—everywhere you look you find a demand for men—not just ordinary workers, but men who know more than their fellows, who are better at their jobs, who know both theory and practice and can therefore train other men, thus rising to more and more important stations and being of greater and greater help. Practically every industry is included in those needing MEN, trained men, skilled men, men with ambition and punch.

### Learn at Home

Over 40 years ago we developed a system of home study which has helped thousands of men to important positions in the mechanical and business world. Those of you who have missed college training, who haven't the time to go away to school, who must LEARN AS THEY EARN, can get education in your particular field—yes, education of college grade right in your own home. Best of all, you can study when you have the time, and above everything else you will have the commendation and the respect of your employers in doing so. Rest assured that every superintendent, every factory manager, every general manager will have his eye on the man who pushes forward, who recognizes the great need of the day, and who has made up his mind to be one of the first to make good.

### Business Welcomes Applications from American School Advanced Students and Graduates

Whenever trained men have been badly needed, business has been quick to say, "We welcome applications from American School advanced students and graduates." We maintain an employment placement service to help put you in touch with the best openings, and we make no extra charge of any kind for this service. Write now for an outline of home study training courses; check the coupon indicating your preference and mail it promptly.

**AMERICAN SCHOOL**

Dept. G946, Drexel at 58th, Chicago



### Rich Rewards

In bidding for skilled men now, industry of all kinds, everywhere in the United States is offering top pay. They want the best men and they are willing to pay for their services. But remember this, you not only have opportunities for bigger pay than you probably ever hoped for, but the chances for advancement are even greater. Foremen, superintendents, factory managers, must be drawn from the ranks, and surely you know that the man who studies, who tries to know everything there is to know about his job will be picked first. Best of all, under the present training program, with the tremendous need for skilled men you don't have to look too far in the future for:

Results  
Come  
Quickly

### Get the Facts

(No Cost) All you have to do to find out about this type of training, to get the details and the outline of study, with histories of the successes of other men, is to write us or send the coupon. There is no cost and no obligation of any kind. Let this great school, one of the pioneers in the home study field, explain the methods which can do so much for you. Get this information now so that you can make up your mind quickly to get started on the road to the fulfillment of a real ambition, and so that you may be of the greatest possible help in this present emergency.

### Mark, Clip and Mail This Coupon NOW!

AMERICAN SCHOOL, Dept. G946, Drexel at 58th, Chicago

Without obligation, Please send FREE and postpaid, bulletin and details of the Subjects checked.

<input type="checkbox"/> Air Conditioning	<input type="checkbox"/> Retail Merchandising	<input type="checkbox"/> Drafting and Design
<input type="checkbox"/> Elec. & Gas Refrigeration	<input type="checkbox"/> Cost Accounting	<input type="checkbox"/> Radio and Television
<input type="checkbox"/> Architecture and Building	<input type="checkbox"/> Practical Bookkeeping	<input type="checkbox"/> High School
<input type="checkbox"/> Plumbing and Steam Fitting	<input type="checkbox"/> Economics of Direct Selling	<input type="checkbox"/> Home Economics Courses
<input type="checkbox"/> Automotive Engineering	<input type="checkbox"/> Private Secretary	<input type="checkbox"/> Business Law
<input type="checkbox"/> Aviation Drafting	<input type="checkbox"/> Diesel Engineering	<input type="checkbox"/> Liberal Arts
<input type="checkbox"/> Aviation Engineering	<input type="checkbox"/> Surveying & Topographical Drafting	<input type="checkbox"/> Mechanical Engineering
<input type="checkbox"/> Business Management	<input type="checkbox"/> Sheet Metal Pattern Drafting	<input type="checkbox"/> Shop Management
<input type="checkbox"/> Accounting and C.P.A.	<input type="checkbox"/> Electrical Engineering	<input type="checkbox"/> Tool Making
<input type="checkbox"/> Salesmanship		<input type="checkbox"/> Better Foremanship
		<input type="checkbox"/> Engine and Boiler Work

Name..... Occupation.....

Address..... Age.....

City..... State.....



R. E. BRANDEL, Editor

## They Keep On Earning Money by Easy Electroplating



THE MAN who dreams of earning extra money, as much as \$50 or \$60 per week, need not dream in vain. Brush electroplating offers that opportunity. Here's what Jasper Brown of Chicago says: "I bought my electroplater to exper-

iment with during my spare time. In a few evenings I earned the cost of the machine by plating jewelry, silverware, headlight reflectors, etc., for friends and neighbors. Now I have all I can do. I recommend this machine to all who want a profitable business."

Jasper Brown is headed for a business of his own, apparently. Restaurants, music stores, doctors, dentists and garages are only a few of the many sources of business for the electroplater who wants to hear more cash jingling in his pocket.

J. J. Wilson, Slidell, La., writes: "After I received my electroplater I practiced for about an hour. I made up four samples and went out after business. One of the large chain restaurants now has me do all their silverware."

Max Hemmert, Idaho Falls, Idaho, states: "I am now spending all my time in plating work. I purchased a brush plater last summer and have worked up a very promising business."

Frank Welde, Philadelphia, goes after garage business. He writes: "I electroplated a few brass strips for samples. I then showed these strips to different people and that's how I got plenty of jobs. I have all the work from a big garage. The owner gets 10% of what is charged his customers, and the rest goes to me for my work."

## MAKE BIG MONEY at HOME! NEW INVENTION Electroplates by Brush



FREE  
SAMPLE and  
BOOKLET  
EXPLAINS ALL

New, patented invention makes possible big earnings AT HOME. Replate auto-parts—worn articles in homes, stores, hotels, restaurants, etc., with durable, sparkling, new coat of metal—with stroke of brush. Easy, simple, quick. Genuine Gold, Silver, Nickel, Cadmium, etc. Everything furnished. Outfit complete, ready for use. No shop required. Clear from \$2 to \$5 an hour in lifetime business. Small investment starts you in business. Steady repeat. Machine can pay for itself in week. Send TODAY for FREE SAMPLE and illustrated BOOKLET how you can have a life income from a business of YOUR OWN built upon satisfied customers. Act at once!

**WARNER ELECTRIC COMPANY**  
225 N. Wabash Ave., Chicago, Ill., Dept. 124

## Readers Say:

### Now the Only Thing We Lack Is Some Juicy Fish Stories

IN MY opinion, P. S. M. rates top place in its field. There is, however, one thing lacking—a good, juicy article on tropical fish every now and then. I always look for any notes on fish, and was thrilled when I read the letter of F. C. H., of Boulder, Colo., about his garden pool. I have an indoor set-up, but am experimenting on the line of keeping goldfish dormant for a few months at a time. Perhaps some other readers have some ideas along this

line.—H. O., Stamford, Conn.

### Next We'll Have to Do It with Just Half a Tube

JUST a line to let you know that I built the "Europe on One Tube" radio described in your April 1940 issue and it really hops the ocean. I can get London or Berlin any night. Just a suggestion, though: If the fixed .01 condenser in the antenna is changed to a variable 15 to 30 mmfd., the set will tune much better. Each month the radio section is the first I turn to. Let's have more A. C. short-wave sets.—J. R. (W8SWL), Huntington, W. Va.

### He Waives His Back Issues to Save Cargo Space

THANK you for your offer to supply duplicate copies of P. S. M. for issues not received because of change of address. However, I do not think it right to make a claim for back numbers of the magazine, in view of the more valuable cargoes plowing their dangerous ways over seas fraught with peril and under skies equally menacing. So we'll say nothing of numbers missed and be thankful to get any at all.—Capt. E. L. F., London, England.



# INVENTORS!

*Read* HOW CLARENCE A. O'BRIEN  
MADE IT *EASY* FOR ME TO  
PATENT AND SELL MY INVENTION

## THE AMAZING SUCCESS STORY OF A. L. M. (name on request) TOLD HERE IN HIS OWN WORDS

"I AM glad to tell the story of how I got started on the road to my present success, because I feel certain that it will be of real interest and possible inspiration to other inventors who are just starting out.

While attending a technical school I became very much annoyed with the inadequacy of one of the tools required in the course of my study. As a result I conceived an idea for an improvement which I felt so surpassed the tool then used, that I was certain other students and professional men would find it very valuable. I demonstrated it to my friends and they were so greatly impressed with its commercial possibilities, that they advised me to get a patent on it.

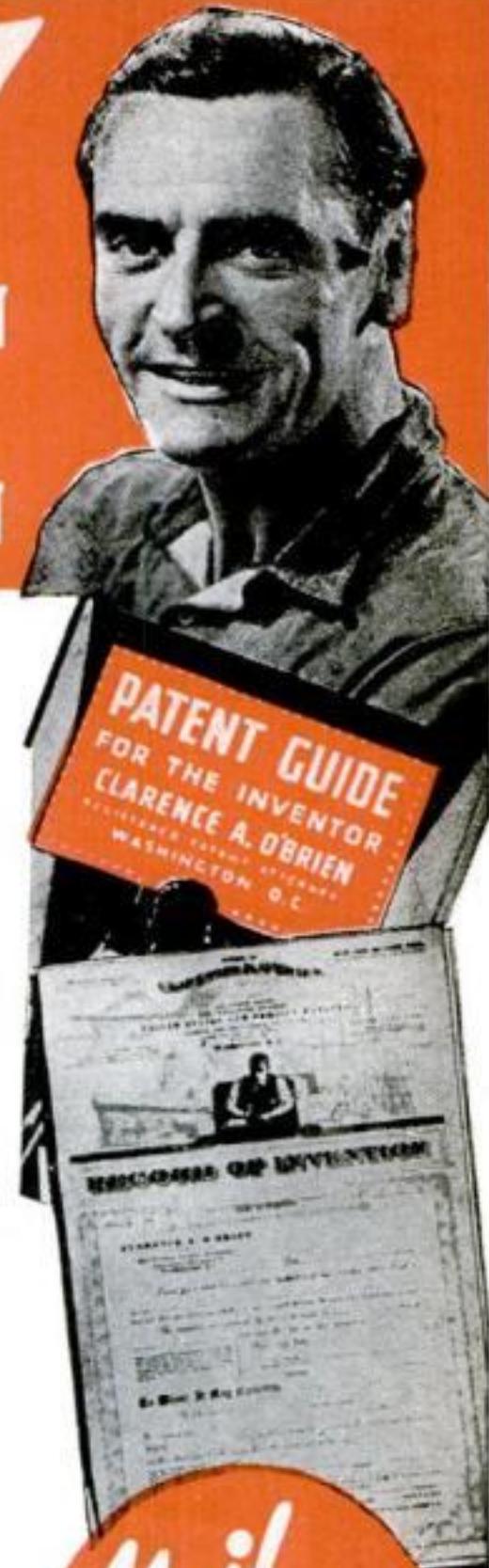
Acting immediately upon this suggestion, I wrote to Clarence A. O'Brien, having been advised that he was a reliable and competent registered patent attorney. Following prompt instructions from Clarence A. O'Brien, I submitted my invention to him for the purpose of making a preliminary patentability search of the Patent Office records. The good word soon came back . . . my invention appeared to be patentable! I believe that this was one of the greatest moments of my life. Armed with this assurance, I promptly filed application for a patent. As soon as the patent was thus pending, I was in a position to commence volume production of my invention. I then arranged an interview with one of the largest manufacturers in the business, and demonstrated the model to him, since in the meantime

Clarence A. O'Brien had secured the necessary patent for my invention. The manufacturer was so favorably impressed, that he gave me a substantial order. He was so pleased with the sales results of my invention that he is now reordering in great quantities. Other manufacturers caught up the idea, and today I am supplying most of the market, and am protected against infringement by the patent obtained through the efforts of Clarence A. O'Brien.

I feel that the whole basis of my good fortune may be traced to the intelligent, careful cooperation of Clarence A. O'Brien in securing a patent on my invention. Without the assistance of Clarence A. O'Brien, my tremendous success would not have been possible . . . I can whole-heartedly recommend his services to any inventor who has an idea worth protecting by a U. S. Patent."

### A PATENT IS YOUR FIRST STEP

If you would protect yourself against the scheming activities of unscrupulous imitators, a patent obtained from a reliable registered patent attorney is a very necessary prerequisite. Do not be misled by claims that protection may be secured by any method other than a U. S. Patent . . . and do not run the risk of obtaining your patent through the services of anyone other than a registered patent attorney. Clarence A. O'Brien is a registered patent attorney before the U. S. Patent Office, and is qualified by more than twenty years of actual patent law practice to give you the kind of service you deserve. Remember, a patent . . . as such . . . is valueless, unless it specifically protects you . . . but good claims . . . against infringement by imitators. Every member of Clarence A. O'Brien's staff is completely qualified to help in giving you every service that can contribute toward patent protection.



**Mail  
Coupon  
for FREE**  
PATENT GUIDE AND  
RECORD OF  
INVENTION  
FORM

**ACTION IS IMPORTANT** *Mail Now*

#### CLARENCE A. O'BRIEN

Registered Patent Attorney  
before the United States Patent Office

Dept. 1MR2, Adams Building, Washington, D. C.

Please send me your 48-Page Patent Guide and your specially prepared "Record of Invention" form FREE. This request does not obligate me.

Name.....

Address.....

City..... State.....  
(Please write or print plainly)

**CLARENCE A. O'BRIEN**  
"Worthy of your Trust"  
REGISTERED PATENT ATTORNEY  
WASHINGTON, D. C.

**DEFENSE  
INVENTIONS**  
Inventions which  
might be considered  
of value to  
National Defense  
are given special  
attention, even to  
the extent of as-  
sisting in submit-  
ting to proper  
authorities.

# NEWS

Increased production  
means



## MORE JOBS for MACHINISTS and bigger pay for men who know their work

This home-study course gives you the practical facts on modern machines, up-to-date methods, you need to advance in machine shop work. Take advantage of the other man's experience as found in books, to solve your problems, increase your efficiency, with

### The AMERICAN MACHINISTS' LIBRARY

6 volumes—2368 pages—2516 illustrations  
(A combined home-study course and reference library)

This library of machine shop practice was written for practical men. It gives you the best methods for every kind of machine shop work. It fully explains lathes, drills, and other machine tools and their operation, automatic screw machines, speeds and feeds, gear design and production, jigs and fixtures, punch and die work, metal surfacing, etc., etc. Plainly written—completely illustrated—the best kind of help to the machine shop man who wants to advance himself.

No money down—special price—easy payments.

#### EXAMINATION COUPON

McGRAW-HILL BOOK CO., 330 W. 42nd St., New York  
Send me for ten days' examination the American Machinists' Library. If satisfactory I will send you \$1.50 in 10 days and \$3.00 monthly until the price of \$19.50 is paid. If not wanted, I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

Name.....  
Home Address.....  
City and State.....  
Position.....  
Name of Company.....

PSM-12-41

## QUICK WAY TO LEARN MUSIC —play any instrument

GET A REAL thrill out of music! Play the musical instrument you like best. Start right in with simple tunes. No tedious, old-fashioned drills and exercises.

It's easy! Everything is in print and picture. You see every position and move. Thousands have been amazed at their progress in just a few short weeks. Now they're sought-after guests for every party! Don't miss out on the popularity that is rightfully yours!

Mail coupon today for free illustrated Booklet and Print and Picture sample that show how easily and quickly you can learn music at home. Just check instrument that interests you. (Instruments supplied when needed, cash or credit). U. S. School of Music, 812 Brunswick Bldg., New York City.



#### FREE PRINT and PICTURE SAMPLE

U. S. School of Music, 812 Brunswick Bldg., N. Y. C.

Please send me Free Booklet and Print and Picture Sample. I would like to play instrument checked below. (Do you have instrument.....)

Piano Accordion Trumpet Ukulele  
Violin Saxophone Trombone Other Instrument  
Guitar Mandolin Banjo

Name.....

Street.....

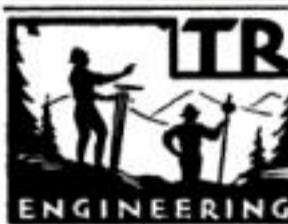
City..... State.....

FEATURED WITH WOODY HERMAN

## SAXIE MANSFIELD RECOMMENDS THE MARTIN SAXOPHONE

Think of the fun and excitement that come from playing the same saxophone you hear featured on your favorite records and radio programs. Take good advice and get off to a flying start with a Martin. Send for FREE folder and photo of Saxie Mansfield.

MARTIN BAND INST. COMPANY  
Dept. P-12, Elkhart, Ind.



## TRI-STATE COLLEGE

B. S. Degree in 2 1/4 Years

World famous for technical 2 1/4-year courses in Civil, Electrical, Mechanical, Chemical, Radio, Aeronautical Engineering; Business Administration and Accounting. Special preparatory department for those who lack required high school work. Short diploma courses (36 weeks) in Surveying, Drafting. Low tuition. Low living costs. Students from every state and many foreign countries. 58th year. Enter January, March, June, September. Write for catalog. Burton Handy, Pres., 5121 College Ave., ANGOLA, INDIANA.

## STUDY AT HOME

With A Chartered Educational Institution  
Conducted by Correspondence

Courses in Arts; Sciences; Philosophy; Education; Public Health; Medical Jurisprudence; Psychology; Sociology; Physics; Chemistry; Geology; Pol. Science; Theology; Law; Business Training; Accounting; Statistics; Agriculture; Engineering; Electrical; Civil; Mechanical; Drafting; Architectural; Automotive; Steam; Diesel; Aeronautical; Radio; Structural; Industrial; Highway; Petroleum; Mining; Marine; Refrigeration; Air Conditioning; Chemical. McKinley-Roosevelt Corporation, 4610-AC Sheridan Road, Chicago

You Can  
Learn To

## Be an ARTIST



Trained Artists Are Capable of Earning \$30, \$50, \$75 Weekly. Many of our graduates are now enjoying successful Art careers. By our practical method, famous since 1914, we teach you Commercial Art, Cartooning and Illustrating—one course—AT HOME IN YOUR SPARE TIME. TWO ART OUTFITS furnished. Write for details in FREE BOOK. "Art for Pleasure and Profit," explains course and opportunities. No obligation. State age.

STUDIO 1312T WASHINGTON SCHOOL OF ART  
1115-15th Street, N. W. Washington, D. C.

## YOUR OWN BUSINESS

### MAKING CASTINGS FOR US

We need additional full or spare time manufacturers to cast for us Christmas Goods, 5 and 10c Novelties, Ashtrays, Toy Autos, Soldiers, etc. Can be started in any spare room and no experience necessary. An opportunity to be your own boss and make real money. For full information about this interesting and profitable work write:

METAL CAST PRODUCTS CO.  
1696 Boston Road

Dept. E.  
New York, N. Y.

Regain Perfect Speech, if you

## STAMMER

Every stammerer should have the new 287 page book "Stammering, Its Cause and Correction". Sent free to stammerers. It describes the Bogue Unit Method for the scientific correction of stammering and stuttering. Method successfully used at Bogue Institute for 40 years—since 1901. Endorsed by physicians. Write for full information. No obligation.

Benjamin N. Bogue, Dept. 982 Circle Tower, Indianapolis, Indiana.



## LEARN WELDING

Both Electric Arc and Acetylene by practical Shop-Plan method in a few short weeks. No text-books. You learn by doing. Finest equipment. Low tuition. Pay-After-Graduation-Plan. Also, courses in Auto Mechanics, Collision Work, Metal Finishing, etc. Illustrated literature free. Write today.

MICHIGAN TRADE SCHOOL  
3718 Woodward, Detroit, Mich.

FREE  
32 PAGE  
CATALOG

GEE what a build!  
Didn't it take a long  
time to get those muscles?

No SIR! - ATLAS  
Makes Muscles Grow  
Fast!

# Will You Let Me PROVE I Can Make YOU a New Man?

LET ME START SHOWING RESULTS FOR YOU

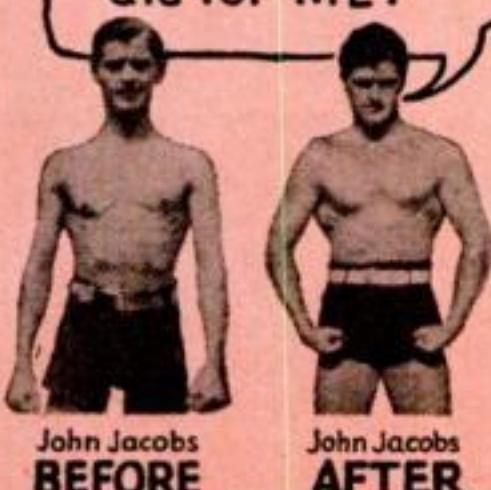
5 inches  
of new  
Muscle

"My arms increased  $1\frac{1}{2}$ ",  
chest  $2\frac{1}{2}$ ", forearm  $\frac{7}{8}$ .  
—C. S., W. Va.

What a  
difference!

"Have put  $3\frac{1}{2}$ "  
on chest (nor-  
mal) and  $2\frac{1}{2}$ "  
expanded." — F. S.,  
N. Y.

Here's what ATLAS  
did for ME!



John Jacobs  
BEFORE

John Jacobs  
AFTER

For quick results  
I recommend  
**CHARLES  
ATLAS**

"Am sending snapshot show-  
ing wonderful progress."  
—W. G., N. J.

GAINED  
29  
POUNDS

"When I started, I  
weighed only 141. Now  
weigh 170." T. K., N. Y.

## CHARLES ATLAS

Awarded the title  
of "The World's  
Most Perfectly  
Developed Man"  
in international  
contest—in com-  
petition with  
ALL men who  
would consent to  
appear against  
him.

This is a recent  
photo of Charles  
Atlas showing  
how he looks to-  
day. This is not a  
studio picture  
but an actual un-  
touched snapshot.



## Here's What Only 15 Minutes a Day Can Do For You

I DON'T care how old or young you are, or how ashamed of your present physical condition you may be. If you can simply raise your arm and flex it I can add SOLID MUSCLE to your biceps—yes, on each arm—in double-quick time! Only 15 minutes a day—right in your own home—is all the time I ask of you! And there's no cost if I fail.

I can broaden your shoulders, strengthen your back, develop your whole muscular system INSIDE and OUTSIDE! I can add inches to your chest, give you a vise-like grip, make those legs of yours lithe and powerful. I can shoot new strength into your old backbone, exercise those inner organs, help you cram your body so full of pep, vigor and red-blooded vitality that you won't feel there's even "standing room" left for weakness and that lazy feeling! Before I get through with you I'll have your whole frame "measured" to a nice, new, beautiful suit of muscle!

### What's My Secret?

"Dynamic Tension!" That's the ticket! The identical natural method that I myself developed to change my body from the scrawny, skinny-chested weakling I was at 17 to my present super-man physique! Thousands of other fellows are becoming marvelous physical specimens—my way. I give you no gadgets or contraptions to fool with. When you have learned to develop your Strength through "Dynamic Tension" you can laugh at artificial muscle-makers. You simply utilize the DOR-

MANT muscle-power in your own God-given body—watch it increase and multiply double-quick into real, solid LIVE MUSCLE.

### Only 15 Minutes a Day

My method—"Dynamic Tension"—will turn the trick for you. No theory—every exercise is practical. And, man, so easy! Spend only 15 minutes a day in your own home. From the very start you'll be using my method of "Dynamic Tension" almost unconsciously every minute of the day—walking, bending over, etc. — to BUILD MUSCLE and VITALITY.

### FREE BOOK "Everlasting Health and Strength"

In it I talk to you in straight-from-the-shoulder language. Packed with inspirational pictures of myself and pupils—fellows who became NEW MEN in strength, my way. Let me show you what I helped THEM do. See what I can do for YOU! For a real thrill, send for this book today, AT ONCE. CHARLES ATLAS, Dept. 1MC, 115 East 23rd St., New York City.

**CHARLES ATLAS, Dept. 1MC**  
115 East 23rd St., New York, N. Y.

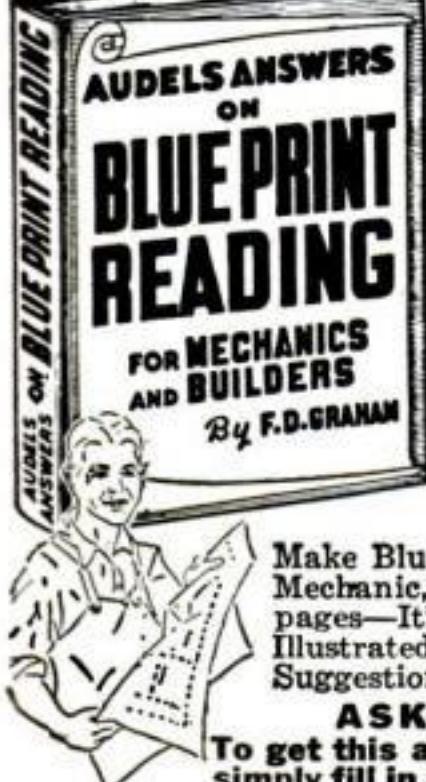
I want the proof that your system of "Dynamic Tension" will help make a New Man of me—give me a healthy, husky body and big muscular development. Send me your free book, "Everlasting Health and Strength."

Name..... (Please print or write plainly)

Address.....

City..... State.....

# AUDELS BLUEPRINT READING



## JUST OUT—FOR THE MAN WHO WORKS FROM BLUE PRINTS

"The Blue Print of Today is the Machine of Tomorrow." AUDELS ANSWERS ON BLUE PRINT READING covers All Types of plan reading including AIRCRAFT & SHIP BUILDING — tells How to Easily Understand Working Drawings.

What to look for first. Tells what each Line and each Symbol Means. The relation of one part to another. How to Understand Scales & Specifications. How to Make a Sketch. How to Make Blue Prints. A Key Book for Every Mechanic, Builder & Draughtsman—352 pages—It's New, Comprehensive. Fully Illustrated. Gives Short Cuts. Helps, Hints, Suggestions. Questions and Answers.

### ASK TO SEE IT!

To get this assistance for yourself, \$2 simply fill in and mail coupon today.

**AUDEL**, Publishers, 49 West 23rd St., New York  
Please mail AUDELS BLUE PRINT READING (Price \$2). If satisfactory, I will remit \$2 on its safe arrival, otherwise I will return the book.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
Occupation \_\_\_\_\_  
Company \_\_\_\_\_ PSM

**LOVE THE LIFE YOU LEAD...**



**AND YOU WILL** if you live in a Schult! Latest models offer every facility for gracious, rent-free living, or low-cost travel. Roomy, attractive, completely furnished, with more floor and storage space and all-weather insulation.

### SCHULT LEADS IN QUALITY

A Schult is TOPS in design, construction, fixtures and finish. That's why more people live and travel in them than in any other make. See latest models at your dealer's, or write SCHULT TRAILERS, INC., Dept. 3112, Elkhart, Indiana.

Write  
FOR FREE  
CATALOG

**SCHULT**  
TRAILERS

## EASIEST to MASTER

A NEW  
**BUESCHER** *True Tone*

HORACE PERAZZI

BERNE CUMMINS

Like many  
Famous Band Leaders  
Bernie Cummins features  
an all Buescher  
Sax Section

JUST OUT—new—radically improved Buescher Saxophone that enables you to master tunes easier than ever; qualify for band in a very short time. Then popularity plus friends; good times; and extra money. NO instrument equals Buescher for quick results. FREE Home Trial, easy payments, any instrument, sax, trumpet, trombone. Write today.

**BUESCHER BAND INSTRUMENT CO.**  
Dept. 1213 - - - ELKHART, INDIANA

**FREE** Beautiful 32 Page Magazine on Music. Send Card—Mention Instrument That Interests You

## ENGINEERING DEGREE IN TWO YEARS

B. S. Degree courses in engineering: Electrical, Civil, Chem., Mechanical, Radio or Aeronautical. 1 yr. Mech. Drafting. Approved by Civil Aeronautics Authority, participation in Pilot Training Program. Large industrial center. Prep courses without extra charge. Earn board if desired. Low tuition. Enter December, March, June, September. Write for Catalog.

6121 E. Washington Blvd., Fort Wayne, Ind.

**INDIANA TECHNICAL COLLEGE**

## ANY BOOK IN PRINT!

Thousands of Books—  
**1/2 price and less**  
Delivered at your door. We pay postage. Standard authors, new books, popular editions, fiction, reference, medical, mechanical, children's books, etc.—all at guaranteed savings. Send card now for Clarkson's 1942 Catalog.

**FREE** Write for our great illustrated book catalog. A short course in literature. The buying guide of 300,000 book lovers. The answer to your Christmas gift problem. **FREE** if you write **NOW—TODAY!**

**CLARKSON PUBLISHING COMPANY**  
Dept. PS1 1253 So. Wabash Ave., Chicago, Ill.

**THERE'S MONEY IN CARTOONS!**

RAYE BURNS will teach you HOW to CREATE ORIGINAL CARTOONS at home that you may SELL! Course contains 26 lessons and over 600 illustrations. All for Only... \$2.85

Send name and address for free details.

**RAYE BURNS SCHOOL**, Dept. S, Box 3583, CLEVELAND, OHIO

When Writing Advertisers  
Please Mention POPULAR SCIENCE

### Correspondence Courses in RADIO and ELECTRICAL ENGINEERING

LOW AS  
**\$25** **LES**  
AUSTRIA  
ARGENTINA

**ELECTRICAL ENGINEERING.** Get good grasp of wide electrical field. Modern. Very understandable. Theory made easy. **RADIO ENGINEERING.** Extra fine course in radio, public address, photo-electric work. Trains you to be super-service man, real vacuum tube technician. Tuition ONLY \$25, either course. Deferred payment plan. Experiment kits furnished. **FREE** Write for free copies of school catalogs, student magazines, etc.

**LINCOLN ENGINEERING SCHOOL**, Box 931536, Lincoln, Neb.

**New Catalog**

**GENUINE U. S. BARGAINS**  
O. D. Wool Blankets (used) ... \$2.19  
McClellan Saddles (used) ... 5.95  
U. S. Army Pup Tents (used) ... 2.50  
U. S. Marine Ponchos (Used) ... 1.29  
Thousands of other bargains in military, outdoor & sport goods for hunter, farmer, scout. Send 10c for 32 page catalog returned with first order.

**A and N SUPPLY CO.**  
4784 LESTER ST. RICHMOND, VA. EST. 1868



**ITCH STOPPED QUICKLY**  
Quick relief from itching of eczema, rashes and other externally caused skin troubles  
35c bottle, at druggists, proves it or money back

**Use D.D.D. Prescription**

# The Curse of Ignorance!



**BROTHER, it's time to WAKE UP! It's time to REALIZE that in this cold, competitive world, ignorance — lack of TRAINING — is a CRIME! And the punishment is INSECURITY —LOW PAY—NO PROMOTIONS—FAILURE!**

**You can't change the world — but YOU CAN CHANGE YOURSELF! You can become a TRAINED MAN! How? By using your leisure time to prepare yourself for ADVANCEMENT! Thousands of former I. C. S. students are among today's business leaders! This coupon will bring you information. MAIL IT!**

**INTERNATIONAL CORRESPONDENCE SCHOOLS**  
CELEBRATE 50 YEARS OF SERVICE TO AMBITIOUS AMERICANS

**1891-1941**

**BOX 7622-K, SCRANTON, PENNA.**

★ Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the course *before* which I have marked X: ★

**TECHNICAL AND INDUSTRIAL COURSES**

- Agriculture    Air Brake    Contracting and Building
- Air Conditioning    Cotton Manufacturing    Diesel Engines
- Airplane Drafting    Electrical Drafting    Electrical Engineering
- Architectural Drafting    Electric Lighting    Electric Lighting
- Architecture    Foundry Work    Heating
- Auto Engine Tune-up    Heat Treatment of Metals    Highway Engineering
- Auto Technician    House Planning    Locomotive Engineer
- Aviation    Aviation Mechanic    Machinist
- Boilermaking    Management of Inventions    Mfg. of Pulp and Paper
- Bridge Engineering    Mining
- Chemistry    Motor Vehicles
- Civil Engineering    Motor Vehicles
- Coal Mining    Motor Vehicles
- Concrete Engineering    Motor Vehicles

**BUSINESS COURSES**

- Accounting    Advertising    College Preparatory    Foremanship    French
- Bookkeeping    Commercial    Good English    French
- Business Correspondence    Cost Accounting    High School    French
- Business Management    C. P. Accounting    Illustrating    French
- Cartooning    Civil Service    First Year College    Managing Men at Work

- R. R. Signalman    Refrigeration
- Sanitary Engineering    Sheet Metal Work
- Ship Drafting    Shop Practice
- Steam Electric    Steam Engines
- Steam Fitting
- Structural Drafting
- Structural Engineering
- Surveying and Mapping
- Telegraph Engineering
- Telephone Work
- Textile Designing    Toolmaking
- Welding, Electric and Gas
- Woolen Manufacturing

- Railway Postal Clerk    Salesmanship
- Secretarial    Spanish
- Showcard and Sign Lettering
- Traffic Management

**HOME ECONOMICS COURSES**

- Advanced Dressmaking    Home Dressmaking
- Foods and Cookery    Professional Dressmaking and Designing

- Tea Room and Cafeteria Management, Catering

Name..... Age..... Address.....

City..... State..... Present Position.....

Canadian residents send coupon to International Correspondence Schools Canadian, Limited, Montreal, Canada

British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England

# DRAFTING

BOOKS SENT FREE!  
ON APPROVAL—5 VOLUMES  
BRAND NEW EDITION

## For Beginners or Experts

Written so you can understand every word, by well known engineers. De Luxe modernistic, washable cloth binding, over 1600 pages, hundreds of blueprints, charts and diagrams; prepares you for a good drafting job in mechanical lines. Sent for 10 days' free use if you mail coupon immediately.

### Big Field • Big Demand • Big Pay

Competent draftsmen are urgently needed in all manufacturing lines at \$30.00 to \$75.00 a week. That's just the beginning—FOR DRAFTSMEN HAVE GOOD CHANCES FOR ADVANCEMENT. Pleasant, fascinating work, easy to learn and do. Learn quickly with these books—send coupon for a set and see for yourself.

*[A year's consulting service now given to all buyers of this famous cyclopedia of drafting.]*

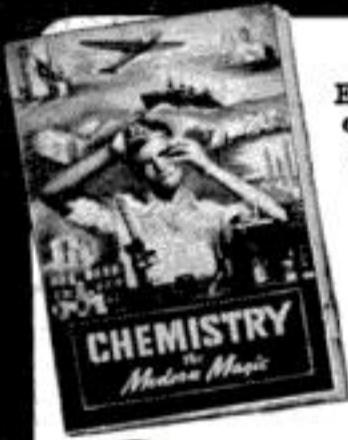
**AMERICAN TECHNICAL SOCIETY**  
Publishers—Home Study Courses

**American Technical Society, Dept. D920, Drexel at 58th St., Chicago, Ill.** Send for 10 days' trial, Brand New 5 volume set of "Drafting for Machine Trades." I will pay the delivery charges only. If I wish, I may return books in 10 days and owe you nothing, but if I decide to keep them, I will send \$2.00 after 10 days, then only \$3.00 a month until \$19.80, the total price, is paid. Send Brand New edition and include Consulting Service Certificate.

Name.....

Address.....  
Please attach letter stating age, occupation, employer's name and address and that of at least one business man as a reference.

## IT'S FREE THIS FASCINATING NEW BOOK



### "CHEMISTRY, THE MODERN MAGIC"

Every red-blooded boy will want to explore the wonders of Modern Chemistry, the science which has enabled our country to maintain leadership in the products of both peace and war.

Chemcraft Outfits have helped millions of boys and girls to understand the importance of chemistry in our daily lives. Many of these today occupy positions of importance in our great industries.

## CHEMCRAFT OUTFITS

are for sale at most leading stores. But insist upon Chemcraft, the original chemistry outfit. Examine their many fine exclusive features, including the largest assortment of high quality chemicals and equipment. If your dealer is out of stock, you may order direct from us.



Chemcraft No. 5—a splendid outfit, 61 chemicals and pieces of apparatus. Manuals explain 586 experiments. Many special features. Price \$5.00.

SEND FOR YOUR  
Free Copy

You'll find fun and adventure in performing the many experiments described in this fascinating book. Read about the great opportunities chemistry offers for the future.

**THE PORTER CHEMICAL COMPANY**  
65 Prospect Avenue, Hagerstown, Md.

Please mention POPULAR SCIENCE when writing to advertisers.

Operator  
No. 38



## Follow This Man!

**Secret Service Operator  
No. 38 Is On The Job!**

Follow him through all the excitement of his chase after the counterfeit gang. See how a crafty operator solves a murder with tell-tale finger prints! Thrills! Mystery!

**FREE!** **The Confidential Reports  
No. 38 Made to His Chief**  
**Earn a Regular Monthly Salary**

Write for reports and free "Blue Book of Crime." Learn how YOU can become a Finger Print Expert, at home, in spare time, at small cost. Our graduates run 43% of all

the Identification Bureaus in America! Send for list of over 750 bureaus employing our graduates. Write today! Literature sent only to persons stating their age.

**INSTITUTE OF APPLIED SCIENCE**

**1920 Sunnyside Avenue Dept. 1369, Chicago, Ill.**

## AN AVIATION CAREER OFFERS YOU GREAT FUTURE!



Demand for trained aircraftsmen is increasing and already exceeds supply. Curtiss-Wright Tech, Aviation's foremost school, is located on Grand Central Air Terminal in heart of the aircraft industry and specializes in training MASTER MECHANICS and AERONAUTICAL ENGINEERS. (No flying involved.) Graduates are obtaining immediate employment. Write for details NOW. Dept. PS-12

**Curtiss-Wright Technical Institute, Glendale (Los Angeles) California**

42nd  
YEAR

## ENGINEERING

DEFENSE  
COURSES

Short, Intensive Defense courses in Aircraft, Sheet Metal, Mechanical, Structural, Architectural Drafting; Electricity; Power Plant; Arc, Aircraft Welding. One and Two-Year courses in Aeronautical, Electrical, Mechanical, Structural, Architectural, Civil Engineering. B.S. Degree 3 Yrs. Low tuition and living costs. Part-time work for room and board. Thousands successful graduates. Extensive equipment. Theory and practice. Non-essentials omitted. No home study courses. Catalog free.

**FINLAY ENGINEERING COLLEGE**

Kansas City, Mo.

## SUCCESS OPPORTUNITIES! → FREE

Do You Want to Get Ahead?

NOW is the time to get a better job, better pay, knowledge and culture that spell happiness, success. See big 1942 illustrated catalog of authoritative, simplified books on aviation, accounting, engineering, English, drafting, radio, history, typewriting, machine shop work, Spanish, secretarial practice, and a hundred other subjects. Many slightly used, as low as 49c, postpaid. Money back if not satisfied. Write for FREE catalog NOW.

**HOME STUDY BOOK CO.**

Dept. 1212, 1251 Wabash Ave., Chicago, Ill.

**CATALOG  
HOME  
STUDY  
BOOKS**  
**Save 1/2**

## ELECTRICITY MEN NEEDED

Electricians are needed everywhere. Hollywood studios alone claim shortage 200 men. This is a live money making profession. Learn at home, spare time. Easy payments. Selective Employment service. Write for FREE Bulletin. No obligation.

**AMERICAN SCHOOL**

Dept. EE946

Drexel at 58 St., Chicago



## ITALIAN ACCORDIONS

HAND MADE. Very best. Lowest prices. Direct from Factory Representative. Send your name and address for FREE catalog.

**ITALIA & P. SOPRANI ACC. MFG. CO.**  
323 W. POLK ST., DEPT. PS, CHICAGO, ILL.

## Get into the BAKING BUSINESS

Bakers make good money! Now 7th Industry in wages! Nearly depression-proof. New home study Baking Course qualifies you. Common school education sufficient. If you're ambitious, write for FREE BOOK, "Opportunities in Baking." National Baking Institute, 1315 Michigan, Dept. 1369, Chicago



## LEARN WATCH REPAIRING



**AT HOME** You can learn by our modern and original system of instruction every part of the Watch Repairing Trade at home. Prepare yourself for a well paying position or start in business after completing our course of instruction. Good watch repairers are in demand and generally earn very good salaries. For particulars apply to the Wisconsin School of Watch Repairing 524 E. Mason St., Dept. P-12, Milwaukee, Wis.

ENTER IN FEBRUARY  
**ELECTRICAL TECHNICIANS  
 URGENTLY NEEDED!**

Bliss graduates are in great demand! To fill this need, an additional class will begin February 10. You start in Feb.—finish in Dec. Instruction is regular Bliss course that has prepared 8,000 men for the electrical field.

This special class will enable you to qualify for the better electrical jobs and you can save valuable months. Bliss graduates hold excellent positions as technicians, engineers. Similar opportunities await you! Send for catalog.

112 Takoma Avenue, Washington, D. C.

**BLISS**  ELECTRICAL SCHOOL  
**RADIO TECHNOLOGY**

RCA Institutes offer an intensive course of high standard embracing all phases of Radio and Television. Practical training with modern equipment at New York and Chicago Schools. Also specialized courses in Aviation Communications, Radio Servicing and Commercial Operating.

Illustrated Catalog on request

**RCA INSTITUTES, INC.** Dept. PS-41

A Radio Corporation of America Service

75 Varick St., New York 1154 Merchandise Mart, Chicago

**Come to this 2 MILLION DOLLAR School**  
**SPARTAN SCHOOL OF AERONAUTICS** 

SPARTAN'S new buildings, new equipment, new training planes, new technical courses representing an investment of \$2,000,000 offer you superior training—tremendous advantages for a successful aviation career. Government Approved—Industry recognized. \$750,000 expansion program making SPARTAN even greater. Skilled personalized instruction for Sheet Metal, Aircraft or Engine Mechanics, Flight, Engineering, Radio, Instrument Mechanics, Meteorology. All recommended graduates receiving immediate employment. Spartan factory, contractor to U.S. Navy, directly connected. Next Semester Starts Jan. 5. WRITE for free catalog. Captain Maxwell W. Balfour, Director—Dept. PS-121, Tulsa, Okla.

**AUDELS Carpenters and Builders Guides**

**4 vols. \$6**



Inside Trade Information On:

How to use the steel square—How to file and set saws—How to build furniture—How to use a mitre box—How to use the chalk line—How to use rules and scales—How to make joints—Carpenters arithmetic—Solving mensuration problems—Estimating strength of timbers—How to set girders and sills—How to frame houses and roofs—How to estimate costs—How to build houses, barns, garages, bungalows, etc.—How to read and draw plans—Drawing up specifications—How to excavate—How to use settings 12, 13 and 17 on the steel square—How to build hoists and scaffolds—skylights—How to build stairs—How to put on interior trim—How to hang doors—How to lay lay floors—How to paint



**THEO. AUDEL & CO., 49 W. 23rd St., New York City**

Mail Audels Carpenters and Builders Guides, 4 vols., on 7 days' free trial. If O.K. I will remit \$1 in 7 days, and \$1 monthly until \$6 is paid. Otherwise I will return them. No obligation unless I am satisfied.

Name.....

Address.....

Occupation.....

Reference.....

DECEMBER, 1941

Please mention POPULAR SCIENCE MONTHLY when writing to advertisers.

PSM

**IMPORTANT Message To  
 INVENTORS**

We Will  
 Send You Our  
**FREE  
 BOOK**

**"HOW TO PROTECT  
 YOUR INVENTION" and  
 Invention Record Form**



Our laws favor the inventor who makes a dated record of his invention, and who is diligent in filing his patent application.

You owe it to yourself, if you value your invention, to make an accurate, dated, and witnessed record of your invention, and then take steps to apply for a patent just as quickly as possible.

**PERSONAL SERVICE**

Hence, our service can be important to you: As soon as you write us, we send, by return mail, an "Invention Record" form for you to fill out. And then, when you return it to us, our prompt and personal service begins: We personally direct the search of the Patent Office Records. Personally report to you. Personally supervise the preparation and filing of your application and the handling of your case. There is no lost motion, no lost time.

**PATENT AND SELL YOUR  
 INVENTION**

We handle your case skilfully and thoroughly with a view to securing the best possible patent for you—giving you the full benefit of our training as patent attorneys and our years of experience serving hundreds of inventors. We make personal calls at the Patent Office when required. And beyond this, we will endeavor to give you useful hints and suggestions on selling your invention.

**WRITE US TODAY . . .**

When your invention comes to us it is strictly confidential. All correspondence is handled personally by us. We take a personal interest in your success, so you can write us fully.

**IMPORTANT TO GET STARTED  
 RIGHT**

Know how the laws protect you, and what steps to take. We will send you Complete FREE Booklet "How To Protect Your Invention", and FREE "Invention Record" Form. Write us, or mail this coupon today—McMorrow and Berman, Registered Patent Attorneys, 142-T Barrister Building, Washington, D. C.

**McMORROW & BERMAN**

**REGISTERED PATENT ATTORNEYS BEFORE U.S. PATENT OFFICE**

142-T Barrister Building

Washington, D. C.

Send me your NEW FREE Book "How to Protect Your Invention" and specially prepared "Invention Record" form at once. I understand that this request does not obligate me.

Name.....

Address.....

City.....

State.....

Write or Print Name Clearly

# America Needs AUTO MECHANICS!

COVERS EVERY PROBLEM THAT CONFRONTS EVEN THE EXPERT

AUTO MECHANIC... EASY-TO-USE...

The National Defense Program has created a shortage of trained Auto Mechanics. Now is the time to extend your knowledge of mechanics and prepare yourself! Regardless of the car you want to repair, MoToR's new Shop Manual will show you the factory-correct way to do the job! Gives official manufacturers' data needed by every mechanic for overhauling or adjusting every American automobile made since 1934. Used daily by thousands of repair shops, students and schools.

567 BIG 8 1/4 x 11 PAGES—850 PHOTOS, DRAWINGS, CHARTS, TABLES

— Give Nearly 200,000 Vital Facts on:

Engine overhaul—Electric system—Fuel system—Cooling system—Clutch—Transmission—Universals—Rear end—Wheels—Brakes—Front end—Shock absorbers—Steering—Ignition—Lubrication—Generators—Carburetors—Oil filters and hundreds of other detailed instructions that describe the exact how-to-do-it of such repairs.

Published by MoToR, 572 Madison Ave., New York, N.Y.  
The Leading Automotive Business Magazine

MoToR, Book Department, Room 2506, 572 Madison Ave., New York

Please RUSH me a copy of MoToR's 1941 Factory Shop Manual. I will pay postman \$3 plus a few cents delivery charge; but it is understood that if book does not satisfy me I may return it within 7 days (and in its original condition) and have the \$3 purchase price refunded immediately. (Foreign Price \$4, cash; no C.O.D. to Canada.)

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_  
OCCUPATION \_\_\_\_\_

Based on  
Official  
FACTORY  
Books  
Covering  
ALL Cars  
1935-1941  
Inclusive  
★  
PRICE  
ONLY  
\$3  
Your Money Back  
if not  
Satisfied

SEND NO MONEY!



# OPPORTUNITY TO EARN \$1040 WHILE LEARNING



Available to Students Through  
Cooperation of Milwaukee Industries

A most unusual offer to qualified men who must earn tuition and part of living expenses while preparing for career as Aircraft Technician, Draftsman, Electro Technician or Welding Technician. Choose any of these four up-to-the-minute practical courses and train for work in vital defense industries. A few more "In Service" fellowships offered by cooperating Milwaukee manufacturers still available. 3-months courses in Aircraft or Arc Welding also offered. Write now for full details and your copy of "Career Building" without obligation. Mention course desired.

MILWAUKEE SCHOOL of ENGINEERING

PS-1241 N. Broadway & E. State

Milwaukee, Wis.

# Learn AUTO-DIESELS

Practical, tested training. Backed by 36 years experience. Course includes Auto Mechanics, Diesel Service and Operation, Diesel Power Generation, Machine Shop Practice, Auto Electrics, etc. Flexible plan to meet specific needs of those with or without jobs. Oldest, largest trade school in West qualifies you and helps you get a good pay job. Transportation allowed to L.A. Earn room and board while learning. Request Free Catalog.

NATIONAL SCHOOLS Dept. 12-PSA  
Los Angeles



T. G. COOKE, Dept. 1369, 1920 Sunnyside Ave., Chicago, Ill.



# MECHANICAL DENTISTRY AT HOME!

To make Crowns, Plates, Bridgework, etc., for Dentists. Easy practical way to learn mechanical dentistry at home in spare time. FULL EQUIPMENT OF TOOLS AND MATERIALS INCLUDED WITH COURSE. Low tuition. Easy terms. Write for FREE BOOK about this money making profession that is not affected by machine age.

McCARRIE SCHOOL OF MECHANICAL DENTISTRY  
207 N. Broad St. Dept. 693 Philadelphia, Pa.



# MAKE MONEY AT HOME



Amazing rubber mold-making outfit makes perfect flexible molds of plaques, ash trays, book-ends, etc. Molds cost from 6c to 25c each. Each mold makes hundreds of novelties and gifts to sell up to \$1.00 apiece! No experience necessary. Quick and easy. Start profitable business in your home, sell to stores, gift shops, friends, resorts, road stands, by mail. Full or spare time. "Molders Handy Book" and list of buyers FREE. Write

SO-LO WORKS  
Dept. D-823 Cincinnati, Ohio



# DRAFTSMEN NEEDED Now



Industry is clamoring for more draftsmen, for the job can't start until plans are drawn. Buildings, airplanes, machines, guns, tanks, bridges, all start on the drafting board, so it's no wonder that every good draftsman has a fine job. Yes, more draftsmen are needed NOW. The pay is good and the opportunities for advancement great.

## Learn at Home in Spare Time

Begin now to turn spare hours into money. Be a draftsman, the connecting link between a mechanic and an engineer. Enjoy the wonderful opportunities for promotion that exist now. No experience or artistic talent is needed. You don't have to leave your present job while learning. Use spare time.

## Employment Service Included

Students who take our home study drafting course are entitled to our employment service without extra charge. We are in constant touch with many great firms needing men, and in times like these Industry welcomes applications from American School advanced students and graduates.

The total tuition cost is low and the monthly payments are easy. Write today for free bulletin outlining our instruction and giving you the details of our selective employment service. No obligation of any kind. Write today.

AMERICAN SCHOOL

Drexel Avenue at 58th St. Dept. DD946 Chicago



## Offers YOU COLLEGE and PROFESSIONAL TRAINING Majoring in AVIATION

Accredited by the Illinois Superintendent of Public Instruction. Included in the Accredited Higher Institutions 1938, issued by the U. S. Office of Education, Federal Security Agency. U. S. approved as a Commercial Ground and Flying School and Mechanics' School. Accredited by and cooperating with the United States Army Air Corps in giving flight and mechanical training. Open to high school graduates. FOUR courses lead to B.S. degrees in Professional Piloting, Aviation Operations, Maintenance Engineering, Aeronautical Engineering.

TWENTY-TWO TRAINING PLANES are used in professional flight training which prepares graduates for airline flight operations. FACULTY of 82 specialists in various fields of aviation. 1569 graduates. Enrollment limited to a total of 300 commercial aviation students. Capacity enrollment of 560. 100-acre airport, 25 buildings devoted to school purposes exclusively. Dormitories and dining hall at the College. Winter term January 5. Send postcard for new 64-page catalog.

15th YEAR Registrar, Dept. PS-12  
PARKS AIR COLLEGE, East St. Louis, Ill.



## EVER BUILT A RADIO?

It's fun—and easy, too, with Lafayette's big new radio and parts catalog! Here's everything you need—America's greatest line of nationally advertised parts, equipment, ham gear, tools, instruction books—all standout values at Lafayette's rock-bottom money-saving prices. Start that radio now. Send for your FREE Lafayette catalog TODAY! Penny post card will do.

901 W. JACKSON BLVD., CHICAGO, ILL.

LAFAYETTE RADIO Dept. GM-1, or 100 SIXTH AVENUE, NEW YORK, N. Y.



MORE DRAFTSMEN NEEDED on planes, motors, equipment. Big pay. Special Aviation Drafting course trains you QUICKLY at home in spare time. FREE Bulletin. No obligation. Address

American School, Dept. A-946, Drexel at 58th, Chicago

## STUDY ENGINEERING AT HOME

With A Chartered Educational Institution

Conducted by Correspondence

Courses in Electrical; Civil; Mechanical; Drafting; Architectural; Automotive; Steam; Diesel; Aeronautical; Radio; Structural; Mining; Industrial; Highway; Petroleum; Marine; Refrigeration; Air Conditioning; Chemical Engineering; Arts; Sciences; Philosophy; Education; Public Health; Medical Jurisprudence; Psychology; Sociology; Physics; Chemistry; Geology; Pol. Science; Theology; Law; Agriculture; Business Training; Accounting; Statistics. Chartered. McKinley-Roosevelt Corporation, 4610-BC Sheridan Road, Chicago



Auto Mechanics and Welders are in big demand. Complete courses in arc and acetylene welding, body and fender bumping, spray painting and metal finishing. Pay after graduation plan. Special low rates. Write today.

MICHIGAN TRADE SCHOOL  
3720 Woodward Ave., Detroit, Mich.

FREE  
32 PAGE  
CATALOG

## BRUSH PLATING OUTFITS

for autoparts, reflectors, faucets, bicycles.

No tanks necessary. Free particulars.

GUNMETAL CO., AVE. F, DECATUR, ILLINOIS



THE PLASTEX Industry needs manufacturers on small scale and for big production of Lamp and Clock Stands, Art Goods and Novelties in Plastex and Marble imitation. Experience unnecessary. 1/2c material makes regular 10c store sellers. Rubber moulds furnished for speed production. Small investment brings good returns. Big chain store orders now being placed. Ambitious men have chance for real prosperity. Our Free booklet will interest and benefit you.

PLASTEX INDUSTRIES, Dept. 2, 1085 Washington Ave., New York, N.Y.

# Aim High

for a real opportunity

You'll  
Probably  
Find it in...

# PLASTICS

Write your own ticket for a future career—and then look at Plastics. Just see the growth of this field today—look at the hundreds of industries now using plastics—picture the tremendous development to come. Here's a new, colorful business—with unlimited possibilities—an industry that's just starting to go places in a big way.

With plastics training you can go farther—go faster—toward success in your chosen field. Become a specialist in plastics through Plastics ITI training. You can train in the industry-type shops and laboratories at the Institute, or start the comprehensive, practical courses in your own home.

For complete information  
on Plastics ITI training  
Write today



## PLASTICS INDUSTRIES TECHNICAL INSTITUTE

194 South Alvarado Street  
Los Angeles, California

### PLASTICS INDUSTRIES TECHNICAL INSTITUTE

Please send information on Plastics ITI training. I am interested in  
 1 year engineering course.  Resident day course.  Combination home study and resident training.  Home study course.

Years High School? \_\_\_\_\_ College? \_\_\_\_\_

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ S-121



## It's Easy To Be A Contractor

Learn to estimate, to plan buildings, to take contracting jobs, and make money on them. Here are 9 up-to-the-minute books on building, estimating, and contracting which cover in an interesting way, the subjects that carpenters, builders, and contractors should know to make the most out of their jobs. Roof Framing, The Steel Square, Architectural Drawing and Design, Estimating, Painting and Decorating, Heating, Air Conditioning, Building, Contracting, Concrete Forms and other subjects are all well covered.

## "Boss" Carpenters in Demand

Vast public works jobs, immense projects, and the rapid growth of home building, are making jobs for MEN WHO KNOW HOW. These books give you quick training. With them you shouldn't be afraid to tackle any job, for needed facts can be found in a hurry.

### Coupon Brings Nine Books FREE For Examination

AMERICAN TECHNICAL SOCIETY (Publishers—Home Study Courses)  
Dept. G920 Drexel at 58th Street, Chicago, Illinois

You may ship me the Up-to-Date edition of your nine big books, "Building, Estimating, and Contracting" without any obligation to buy. I will pay the delivery charges only, and if fully satisfied in ten days, I will send you \$2.00, and after that only \$3.00 a month, until the total price of only \$29.00 is paid. I am not obligated in any way unless I keep the books.

Name.....

Address.....

City..... State.....  
Please attach a letter stating your age, occupation, employer's name and address, and that of at least one business man as a reference.

**New York  
Electrical  
School**  
Established  
1902  
Ask for free  
illustrated booklet  
40 West 17th St., N. Y. C.

**FREE  
BOOK  
TELLS HOW  
YOU CAN  
LEARN TO  
MOUNT BIRDS and  
ANIMALS**

**BE A TAXIDERMIST—Learn by Mail**  
Easy home lessons teach you quickly how to MOUNT BIRDS, ANIMALS, GAME-HEADS, FISH—to TAN LEATHER, FURS. Save your hunting trophies. Have a home museum. It's thrilling! Taxidermy is wonderful, FUN, A PLEASURE HOBBY AND A MONEY MAKER—Investigate! Get this strange FREE BOOK.

**EXTRA MONEY:**—Earn in your spare time. Sell your mounts; and do work for other sportsmen. Students report \$30 to \$75 and more per month. Big demand. Fine prices. If you want REAL PROFIT from spare time WRITE TODAY.

**FREE BOOK**—with 100 photos of wild game. Tells about Taxidermy and how YOU can learn, easily, quickly. Old reliable school, 275,000 students. — STOP this minute and TEAR OUT THIS AD NOW as a reminder; then write; get the free book. You will be delighted, AMAZED. RUSH postal or letter and learn how to have more FUN, FASCINATION, PROFIT. State your AGE. Northwestern School of Taxidermy, Dept. 3399, Omaha, Neb.

Game is growing  
scarcer—every  
specimen valuable!



# Easier THAN EVER

To Master, this New 1942 P-A  
21 Major Improvements

- Just touch a key and blow normally; you can't miss. So easy, and such beautiful tone. Nothing to compare with these new P-A Saxophones, Clarinets, Trumpets, and other P-A instruments. Fully guaranteed; your success assured. See your music dealer or write direct for beautiful

1414

**FREE BOOK**  
No obligation. Easy terms. Greatest fun, easiest with P-A.

**PAN-AMERICAN**  
1204 P-A Bldg. Elkhart, Ind.

Have You Tried a P-A in the Last 30 Days?

## ARTISTS MAKE MONEY

Find out your ability. Send name, age, occupation and address for Free Vocational Art Test.

ART INSTRUCTION, INC., 12141 Art Instruction Bldg., Minneapolis, Minn.  
(Formerly Federal Schools, Inc.)

## Big Money for Workers In Home or Shop



EARN MONEY as Licensed Concrete Specialist. Make lawn pottery without molds. Patented method. Cemetery products, novelties, tiles, floors, color glazing, patching, basement waterproofing. Other projects. Workers wanted everywhere. Booklet, colorplate, details 10c.

**NATIONAL POTTERIES COMPANY**  
Dept. B, 11 W. 26th St. Minneapolis, Minn.



Begin today. Write for our New Free Book, "How to Become a Good Penman," it contains specimens and tells how others learned to write in spare time. Enclose 10c for a Professional Pen Point and your name beautifully written. Write today.

**THE TAMBLYN SCHOOL OF PENMANSHIP**  
439 Ridge Building, Kansas City, Mo.



### GOLDENTONE..50% OFF

Deal Direct—Factory Prices. Over 75 models to choose from—4 to 12 tubes. Portables \$8.98 up. Farm sets \$8.98 up. Car sets \$8.98 up. Foreign band sets \$8.98 up. Samples 50% off. Quantity discounts. Free 1942 Bargain catalog gives details of 10 day FREE trial, agent's proposition and discounts. No obligation. Mail postcard to: DEPT. PS DEARBORN, MICH.

## RUPTURED? GET NEW RELIEF!

Now you can get relief the comfortable, convenient RUPTURE-GUARD way . . . the modern science way that assures better reducible rupture support, greater security, greater body freedom . . . and all without leg straps, without steel springs, without buckles. Write today for FREE full information and see why RUPTURE-GUARD, the elastic support of new design and new efficiency, has produced such happy results and won so many loyal, enthusiastic friends. Liberal trial plan. Write today. Correspondence confidential.

**RUPTURE-GUARD COMPANY, DEPT. 417, BATTLE CREEK, MICH.**

## CASH IN ON SENSATIONAL NEW TAILORING LINE



Sensational news! Show friends complete line men's made-to-measure suits—at low prices—and pocket big CASH PROFITS on easy-payment-plan orders. Scores of rich quality woolens, tailored-to-measure. Newest styles. Guaranteed: YOUR OWN SUITS FREE as a Bonus! No money, no experience needed: We send complete money-making sample outfit FREE and amazing FREE BONUS SUIT offer.

PIONEER TAILORING CO.

Dept. Z-1121

**EARN BIG  
MONEY  
EASY!**

AMAZ-  
ING

## CHEAP OIL BURNER

*Sweeping the Country!!*

**COOK and HEAT** Without Coal  
or Wood

In Your Present Stove or Furnace—

—No Drudgery, Dirt or Ashes—Heat at SMALL COST.

**OVER 40,000 SOLD**

Beats any cheap burner ever gotten out for low cost, efficient performance. Burns low priced free flowing oil. No small openings to clog. Heat Regulated by Turn of Valve—as much or as little as you want. A Guarantee with each burner.

**30 DAYS' TRIAL**

Prove its efficiency, convenience and economical operation.

**Write Immediately for  
SPECIAL OFFER  
TO AGENTS**

who will demonstrate and take orders. Write quick, be first to learn how to make REAL MONEY right now, spare or full time—mail us postcard today.

**UNITED FACTORIES, P-761, Factory Bldg., Kansas City, Mo.**

**AGENTS  
Salesmen  
BIG MONEY**

F. Silver says: "I can dispose of 250 HEAT KINGS before this year ends." Write us now for agents' offer.



**HEAT regulated  
by Turn of Valve!**

## High School Course at Home Many Finish in 2 Years

Go as rapidly as your time and abilities permit. Course equivalent to resident school work—prepares for college entrance exams. Standard H. S. texts supplied. Diploma. Credit for H. S. subjects already completed. Single subjects if desired. High school education is very important for advancement in business and industry and socially. Don't be handicapped all your life. Be a High School graduate. Start your training now. Free Bulletin on request. No obligation.

**American School, Dpt. H946, Drexel at 58th, Chicago**

## WELDING BRINGS TOP PAY

Airplanes, Ships, Tanks, Submarines must be welded. Defense and other industries want more Welding Technicians, Aircraft and Arc Welders. Demand is growing. Ask "How to Earn \$1040 While Learning." Write for FREE 64-page book "Dawn of a Giant Industry." Mention course desired.

**MILWAUKEE SCHOOL OF ENGINEERING**  
PS1241-A N. Broadway & E. State, Milwaukee, Wis.



## ELGIN OR WALTHAM WATCHES

Guaranteed. Reconditioned. Look like \$40-\$50 new watches. Latest styles. Splendid gifts. (Make profits too). Write for illustrated folder. **LEO PEVSNER, 1200-B Mallers Bldg., Chicago.**



## 5¢ LITTLE BLUE BOOKS

Send postcard for our free catalogue. Thousands of bargains. Address: HALDEMAN-JULIUS CO., Catalogue Dept. Desk M-805, GIRARD, KANSAS.

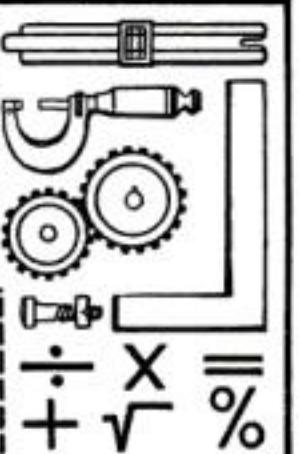
## Short-Cut Mathematics COMBINED WITH Practical Mechanics Simplified

NEW 2-in-1 reading course! Now you can learn the speedy, simplified system of calculation used by draftsmen, engineers, accountants, "master minds" on the stage. Learn easy way to multiply 4 figures by 4 figures without using old-fashioned multiplication; add long columns of figures this lightning short-cut method. Learn horsepower, slide rule, micrometer, logarithms, wood measure, puzzles, etc., etc. Large illustrated volume complete with answers, only \$1 postpaid. Satisfaction or refund. **FREE** Amaze friends with your magic-like mental powers. **Complete details... mail coupon TODAY!**

**NELSON CO., 500 Sherman St., Dept. M-304, Chicago**  
Please send free details about "Short-Cut Mathematics and Practical Mechanics Simplified." No obligation.

Name \_\_\_\_\_

Address \_\_\_\_\_



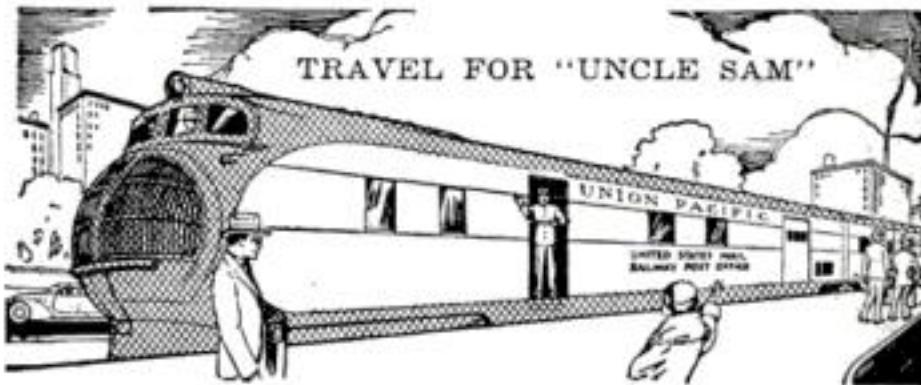
**START**

**\$1260 to \$2100 YEAR**

**Prepare Now for 1942 Examinations**

### Railway Postal Clerks

Railway Postal Clerks get \$1,900 the first year of regular employment, being paid on the first and fifteenth of each month. (\$79.17 each pay day.) Their pay is automatically increased yearly to \$2,300 and \$2,450 in larger organizations. Advance may be had to Chief Clerk at \$2,700 a year. \$112.50 each pay day.) Men, 18 to 35.



**3 Days On—3 Days Off—Full Pay**

Railway Postal Clerks on long runs usually work 3 days and have 3 days off duty or in the same proportion. During this off duty their pay continues just as though they were working. They travel on a pass when on business. When they grow old, they are retired with a pension.

### City Mail Carriers, Post Office Clerks

Clerks and Carriers now get \$1,700 the first year of regular employment and automatically increase \$100 a year to \$2,100. Open to men—women 18 to 48.



### Ass't Statistical Clerk

Open to Men—Women 18 to 50. Entrance salary \$1,620 year. Appointments as Ass't Statistical Clerks and Clerks in the Departments at Washington, D. C., and elsewhere are made from this examination.

### Many Other Positions

Many other positions are obtainable. Those wishing these positions should qualify at once.

### Get Free List of Positions

Fill out the following coupon. Tear it off and mail it today—now, at once.

This small investment may result in your getting a big-paid government job.

### FRANKLIN INSTITUTE, Dept. D251, Rochester, N. Y.

Rush to me, entirely free of charge (1) a full description of U. S. Government Jobs; (2) Free copy of illustrated 32-page book, "How to Get a U. S. Government Job"; (3) List of U. S. Government Jobs; (4) Tell me what to do to qualify for one.

Name \_\_\_\_\_

Address \_\_\_\_\_

Use This Coupon Before You Mislay It. Write or Print Plainly

# SPRAYBERRY RADIO TRAINING

## Includes FULL EQUIPMENT!

Experience Easily Acquired at Home



Over 100 Experiments plus  
Many Other Special Features  
ALL Designed To Help You Make Fast Progress

SPRAYBERRY Training starts right at the beginning of Radio . . . unfolds each subject in a simplified, logical, understandable style. You easily learn Television, Frequency Modulation, Signal Tracing, Mobile Radio (Auto-Tank), Aviation Radio, Electronics, Facsimile Radio, Radio Set Repair and Installation Work.

### Training Prepares You For A Business Of Your Own Or Good Radio Jobs At Excellent Pay

The great fascinating and progressive field of Radio offers many opportunities to the man who wants to get ahead. My Training is designed to give you quick access to these opportunities. SPRAYBERRY Methods are thorough and practical. Your Training will not interfere with your present work.

### No Previous Experience Needed

It makes no difference what your education has been. I can fit you quickly for a good-paying Radio job. I make it easy for you to grasp Radio principles and remember them. Your success is my full responsibility.

### You Get Professional Test Equipment Plus Experimental Outfits

Includes 146 RADIO PARTS (to build complete Receiver), RADIO TOOLS and a modern TESTER-ANALYZER. You also receive 8 BIG SHIPMENTS OF RADIO EQUIPMENT for conducting actual experiments with your own hands.

### Earn While You Learn

My BUSINESS BUILDERS show you how to put your equipment to actual use in handling money-making Radio Service Jobs shortly after you begin Training.

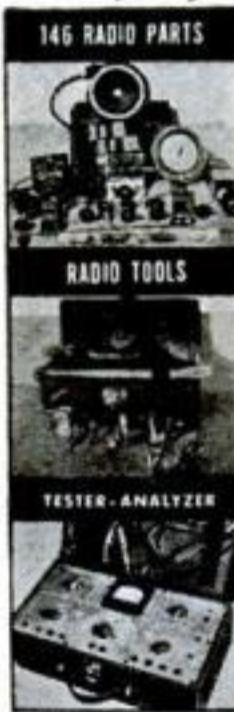
THE SPRAYBERRY COURSE IS SOLD  
UNDER MONEY-BACK AGREEMENT

### RUSH COUPON for BIG FREE BOOK

#### SPRAYBERRY ACADEMY OF RADIO

F. L. Sprayberry, President  
455-M University Place, N.W., Washington, D.C.  
Please rush my FREE copy of "HOW TO  
MAKE MONEY IN RADIO."

Name..... Age.....  
Address.....  
City..... State.....  
(Mail in envelope or paste coupon on penny postcard.)



## "Where training pays" LEARN ACCOUNTING at home —at a fraction of the usual cost

Men trained in accounting have big advantages these days—expanding business and industry must have them; attractive pay; direct road to preferred executive positions or own practice.

GET READY NOW, in spare time, to make most of important new opportunities. Learn by a proved method, through famous university-grade course you can follow by yourself. You receive the identical material—lecture notes and practice assignments with solutions—developed at Northwestern University and now widely used for HOME STUDY. By easy, graded steps, you go from elementary through advanced accounting, including costs, audits—even mathematics. Splendid safeguard to your business future.

### Send for This FREE BOOKLET

Fill in and mail the coupon below for free booklet, "How to Get Ahead Through Accounting," with full details of unique advantages of this practical, low cost course. Write today

### Mail This Request Form



#### THE RONALD PRESS COMPANY

15 East 26th St., New York, N.Y. Dept. M538

Send me, without cost or obligation, a copy of the free booklet giving full information about use for Home Study of the Complete Accounting Course developed at Northwestern University. (No salesman will call.)

Name..... Occupation.....  
(Please print)

Address.....

City..... State.....

## BE PREPARED! LEARN TO SHOOT WITH BENJAMIN



Made in U.S.A.  
For Target—Small Game—Camping. Guaranteed—Accurate—Practical—Economical—Safe—Clean—Quiet. Adjustable Force—Amazing Maximum Velocity. No Smoke or Fumes. Bolt Action—Hammer Fire—Hair Trigger—Safety Lock—Hand Pump. Single Shot BB with 1 lb. shot \$8.50; Single Shot cal. 177 or 22 rifled—with 500 pellets \$10.00; Holster \$2.00. Also a complete line of Benjamin Genuine Compressed Air Rifles for BB and cal. 177 or 22. No license required from dealer or factory. Write Today for complete specifications and free targets.

BENJAMIN AIR RIFLE CO., 852 Marion St., St. Louis, Mo., U.S.A.



• The new clarinet sensation. For the first time an American-made clarinet acknowledged to excel all others in intonation and perfection of scale. Amazing new bridge key protector, adjustable pivot screws, post lock plates. Other exclusive features; yet they cost no more. See your dealer or write us today for free book on clarinets or any other band instrument.

C. G. CONN, Ltd., 1232 Conn Bldg., Elkhart, Ind.

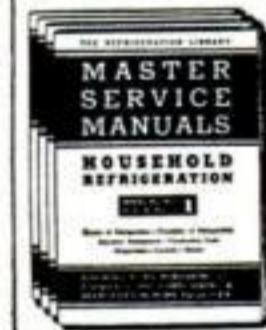
**CONN**  
BAND INSTRUMENTS

## PATENTS PERSONAL SERVICE

My Personal service assures strictest confidence on all your patent problems. Send me a model or drawing, or

sketch and description of your invention, and \$5.00. I will make a search and report promptly as to its patentability and send you a copy of my 72-page booklet. Or, if you prefer to read my booklet first, write today for FREE copy. Registered Patent Attorney.

L. F. Randolph, 340-D Victor Bldg., Washington, D.C.



## LEARN REFRIGERATION at HOME

Simple, easy-to-understand directions for repairing household electric refrigerators. Complete details, diagrams, and photographs. Theory explained in simple terms. These books are authentic. Learn the CORRECT methods.

All yours in four volumes—neat flexible covers—handy size, 6 x 8½ inches—544 pages—only \$4.00. Send cash with order or let us send your set C.O.D. Your money refunded if books are returned within ten days. Write to BUSINESS NEWS PUBLISHING CO., Dept. 33, 5229 Cass Ave., Detroit, Mich.

Send for FREE folder describing other books on refrigeration and air conditioning.

Statement of Ownership, Management, Circulation, etc., required by the Act of Congress of March 3, 1933, of Popular Science Monthly, published monthly at New York, N.Y., for October 1, 1941, State of New York, County of New York, ss. Before me, a notary public in and for the State and county aforesaid, personally appeared Godfrey Hammond, who, having been duly sworn according to law, deposes and says that he is the Business Manager of Popular Science Monthly and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of March 3, 1933, embodied in Section 537, Postal Laws and Regulations, printed on the reverse of this form to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are Publisher, Popular Science Publishing Co., Inc., 353 Fourth Avenue, New York, N.Y.; Editor, Charles R. McLendon, 353 Fourth Avenue, New York, N.Y.; Managing Editor, George H. Waltz, Jr., Business Manager, Godfrey Hammond, 353 Fourth Avenue, New York, N.Y. 2. That the owners are: Popular Science Publishing Company, Inc., 353 Fourth Ave., New York, N.Y.; Stockholders of Popular Science Publishing Company, Inc., Mansell and Company, 45 Wall St., New York; Alice A. Fisher, Greenwich, Conn.; Oliver B. Capen, Bedford Village, N.Y.; Noreen S. Capen, Bedford Village, N.Y.; Robert Cade Wilson, 683 Springfield Avenue, Summit, N.J.; Ada B. Wilson, 683 Springfield Avenue, Summit, N.J.; Marguerite N. Cole, Round Hill Road, Greenwich, Conn.; Raymond J. Brown, 217 Audley St., So. Orange, N.J.; Irma V. Hammond, 163 Brewster Road, Scarsdale, N.Y. 3. That the known bondholders, mortgagees and other security holders owning or holding 1 percent or more of the total amount of bonds, mortgages, or other securities are: none. 4. That the two paragraphs next above giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear on the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustee, hold stocks and securities in a capacity other than that of a bona fide owner, and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) Godfrey Hammond, Business Manager.

Sworn to and subscribed before me this 26th day of September, 1941. Esther Eyl, Notary Public, Kings County Clerk's No. 63, Registry No. 171, New York County Clerk's No. 174, Reg. No. O-E-111.

(Seal) My Commission expires March 30, 1942.

## Now Ready—Our new 1942 Catalog of "HARD-TO-GET" MATERIALS

For Industrial Arts Departments in Schools, Institutions, etc., Furniture Repair Men, Cabinet Makers, Souvenir and Antique Shops, Homecrafters, etc. Send 10c cash or stamps for this new catalog.

A few of the items we sell: Chest hardware, locks, hinges, supports, tray lifts, copper trim, also mouldings, overlays, etc. Finishing materials, glue, stain, varnish, abrasive papers, sanding blocks, stick shellac, etc. Upholstering supplies, coverings and tools. Electrical findings for lamp manufacture, also clusters and indirect fixtures. Chair cane, spine, reeds, craft fibre cord, etc. Trays and glass liners for smoking stands. Large line electric and spring clock movements, with and without dials. Complete line Venetian Blind hardware, cord, tapes, etc. Table slides and supports. Tea wagon wheels and casters. Wood dowels, also dowel screws, dowel centers, wood screw hole buttons. Large line card table leg supports. Bed hardware of every description. Desk pens complete with funnels and fastening without base. Water transfers, inlays, small mouldings, etc. Glides and casters, office chair spiders, wood legs and K. D. chair frames. Small box hardware of every description. Large selection pulls, knobs, handles, hinges, locks, catches, etc. Perforated steel panels, chair braces, revolving chair fixtures, rocker springs, candle-stick sockets, billboard clamps, banquet table hardware, metal drawer glides, brass jack chain, drawer follower blocks, etc. Many styles corner braces, bolts, etc. Step ladder braces, pilaster strips, sliding track and sheaves. Typewriter desk hardware, binswings, mirrors, nut bowl hardware, salt and pepper inserts, music box movements, etc. Bar pins for novelties, dress clips, etc. Catalin plastics, crib hardware, swivel top table fixtures, sectional bookcase hardware, clamp nails, electric pens for burning, etc. Costume jewelry, compact inserts, glass barometers, bud vases, silver glass candles, etc.

Thurston Supply Company, Dept. P. S., Anoka, Minnesota

**FOR SUCCESS IN PHOTOGRAPHY**

**Profit by 31 Years of Experience**

Learn quickly at world's largest, best equipped photo school. Full-time experts coach you INDIVIDUALLY through "Learn by Doing" method in Commercial, News, Portrait, Motion Picture, Color Photography. Resident or home study. Free booklet. **N. Y. INSTITUTE OF PHOTOGRAPHY, Dept. 5, 10 West 33 St., New York, N. Y.**

**SUCCEED IN AVIATION**

Study Aviation at one of America's finest and oldest established Aviation training schools. Modern, fully equipped Airport, Hangars and class-rooms. Expert instructors. Government Approved courses. Leadership training in

**PITTSBURGH INSTITUTE OF AERONAUTICS**

**Free PIPE CATALOG** • **NEW! SAVES YOU MONEY**

396 different pipes, 70 high grade tobaccos, pouches, racks, and humidors, etc., at bargain prices! Tells "How To Keep Pipes Sweet", etc. 44 pages . . . hundreds of illustrations! We ship postpaid all over U. S. Send for free catalog. No obligation. **WALLY FRANK LTD., 10E. 45TH ST., NEW YORK Dept. 87**

## Become a Doctor of PSYCHOLOGY

Win the degree of Ps.D. Teach the secret of contentment, happiness. Solve mental worries. Experience the revelation of truth. Chartered college. Individual help. Write for FREE book. **COLLEGE OF UNIVERSAL TRUTH, 20A E. Jackson Blvd., Chicago.**

**THE ONLY OIL HEATER OF ITS KIND!**

Patented shutters direct radiant heat down to warm the floor . . . while warm air circulates around the room. **SUPERFEX HEAT-DIRECTOR**

PERFECTION STOVE CO., 7323-C Platt Ave., Cleveland, Ohio.

**TYPEWRITER** **1/3 PRICE**

**STANDARD OFFICE MODELS**  
**About 1/3 MFRS. ORIG. PRICE**  
**Easiest Terms as Low as 70¢ A WEEK**  
All models completely rebuilt like brand new.  
**FULL 2-YEAR GUARANTEE**

**No Money Down—10 Day Trial**

**FREE COURSE IN TYPING INCLUDED**  
Send for FREE price smashing literature in colors. Fully describes and shows all models. See our literature before you buy. **SEND TODAY.**

**INTERNATIONAL TYPEWRITER EXCH.**  
Dept. 1207 231 W. Monroe St., Chicago, Ill.

**10c A DAY**

**AUDELS NEW MACHINISTS HANDYBOOK NOW READY!**

**Prepare!**

**A KEY TO SHOP PRACTICE**  
For Every Machinist, Toolmaker, Machine Operator, Draughtsman, Metal Worker, Mechanic or Student. Covers Shop Practice in All Branches.

**A READY REFERENCE**  
Tells How to Operate and Set Up Lathes, Screw and Milling Machines, Shapers, Drill Presses and All Machine Tools.

**5 PRACTICAL BOOKS IN ONE!**  
**60 FULLY ILLUSTRATED CHAPTERS**  
Covering: 1—Modern Machine Shop Practice. 2—Blue Print Reading and How to Draw. 3—Calculations & Mathematics for Machinists. 4—Shop Physics. 5—How to Use Slide Rule.

**Get This Information for Yourself. Mail Coupon Today. No Obligation Unless Satisfied. ASK TO SEE IT.**

**1600 PAGES**  
**FULLY ILLUSTRATED**

**\$4 COMPLETE • PAY ONLY \$1 MO.**

**THEO. AUDEL & CO., 49 WEST 23rd STREET, NEW YORK**  
Mail AUDELS MACHINISTS & TOOLMAKERS HANDY BOOK. Price \$4 on 7 Days Free Trial. If O. K. I will remit \$1 in 7 days and \$1 monthly until \$4 is paid. Otherwise I will return it.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
Occupation \_\_\_\_\_  
Reference \_\_\_\_\_

PSM

## MECHANICS

**KNOW  
YOUR  
CAR**

**You Need  
this  
Book**

**JUST  
OUT!**

**NEW FLUID  
DRIVE FULLY  
EXPLAINED!**

**AUDELS NEW AUTO GUIDE**

**AUDELS AUTO GUIDE FOR MECHANICS OPERATORS & SERVICEMEN**

**READY REFERENCE**

**Ask  
to  
See it!**

**A  
USEFUL  
XMAS  
GIFT!**

**Every operator and mechanic needs AUDELS NEW AUTO GUIDE. This book saves time, money and worry. Highly endorsed. It presents the whole subject of auto mechanics: 1—Basic principles, 2—Construction, 3—Operation, 4—Service, 5—Repair. Easily understood. Over 1500 pages—1540 illustrations showing inside views of modern cars, trucks and buses with instructions for all service jobs. Diesel Engines fully treated, fully illustrated. To Get This Assistance for Yourself Simply**

**\$4 FIN IN and Mail Coupon Today.**

**COMPLETE • PAY ONLY \$1. A MONTH ←**

**THEO. AUDEL & CO., 49 WEST 23rd STREET, NEW YORK**  
Please send me postpaid AUDELS NEW AUTOMOBILE GUIDE (\$4) for free examination. If I decide to keep it, I will send you \$1 within 7 days; then remit \$1 monthly until purchase price of \$4 is paid. Otherwise, I will return it to you promptly.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
Occupation \_\_\_\_\_  
Reference \_\_\_\_\_

PSM



*Now...* YOU CAN'T *Miss* THOSE  
THRILLING FOREIGN STATIONS



NOT JUST 3 BANDS

NOT JUST 4 BANDS...

NOT JUST 5 BANDS, BUT...

MIDWEST'S NEW METHOD  
PLENTY OF ROOM  
BETWEEN STATIONS  
Easy To Tune

ORDINARY METHOD  
STATIONS CROWDED  
Very Hard To Tune

with the  
New 1942 **MIDWEST**  
**SUPER BAND SPREAD CHASSIS!**

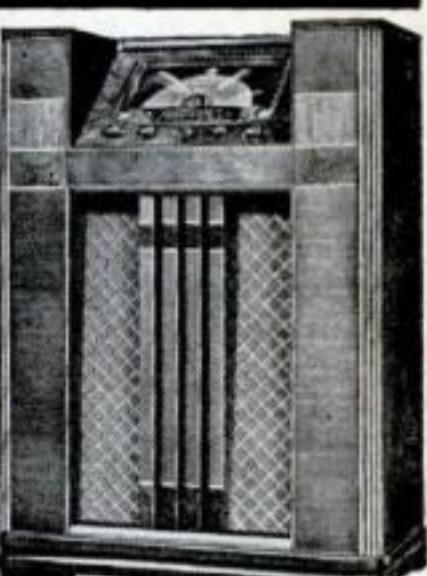
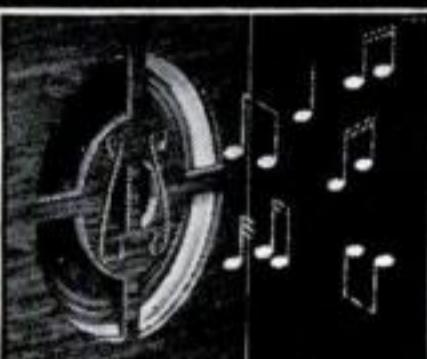


**ENJOY 20 TIMES EASIER TUNING...**

*PUT THIS NEW CHASSIS  
IN YOUR PRESENT CABINET!*

**FACTORY-TO-YOU**

**SAVES <sup>UP</sup> TO 50%**



Acousti-Sonic Louvres with  
Violin-Type "F"-Slot Sounding  
Board . . . just one of 90  
features offered in Midwest  
16-tube radios. They spread  
the High Fidelity  
tones scientifically  
throughout  
the room — prevent  
"directional effect."

**16 TUBES** Model "Y"  
Console

**FILL IN COUPON AND MAIL TODAY OR JUST  
SEND YOUR NAME AND ADDRESS ON A POSTCARD**

**MIDWEST** *factory-to-you* **RADIOS**

MANUFACTURERS OF QUALITY RADIOS SINCE 1920

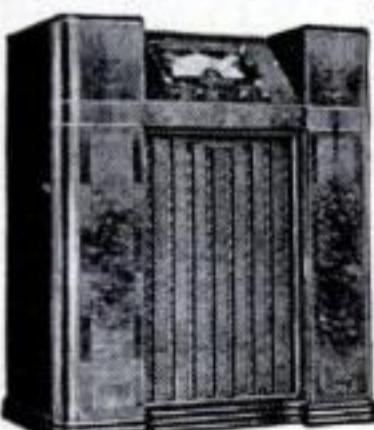
Midwest Radio Corporation  
Cincinnati, Ohio, U. S. A.  
Dept. 59-F

Name.....

Send me your new **FREE**  
Catalog, complete details of  
your liberal 30-day Trial offer  
and factory-to-you prices.

Address.....

Town..... State.....  
User-Agents Make Easy Extra Money. Check here ( ) for details.



**UP TO \$50 TRADE-IN**

... on Many 1942 Models

**YOU GET** the wholesale factory-to-you price when you buy direct from Midwest — you save up to 50% — and you secure so much more in performance and in radio realism. Midwest offers many sensational new features, this year, including 9 bands and **BAND SPREAD TUNING** which make Midwest radios 20 times easier to tune — make them 10 times more sensitive than ordinary radios. And wait until you hear Midwest's Crystal-Clear High Fidelity tone and new vivid realism.

**Enjoy Today's Finest HOME RECORDING**  
Enjoy fascinating entertainment with a Midwest automatic record-playing 8, 11, or 16-tube radio-phonograph. Talk or sing into the studio-type microphone or make a record of your family's voices. Enjoy a full hour of entertainment because up to twelve 10-inch or eleven 12-inch records may be played automatically. Buy your radio the Midwest Home-Trial way! Test it in your home for 30 days before you make up your mind! Write today for big, **FREE** catalog, featuring many beautiful 1942 factory-to-you radio chassis and console values — from 5 to 16 tubes — including Automatic Record-Changing Radio-Phonographs, Home-Recorder, etc., — from \$12.95 to \$212.50.

**Dept. 59-F, The Midwest Radio Corp., Cin'ti, Ohio**

FOR A BETTER JOB  
AND BIGGER PAY

Learn



# BLUEPRINT READING

AMAZING NEW INVENTION

Makes Blueprint Reading  
as Easy as Seeing a Movie

Now, at last, an Amazing New Invention has been perfected by Prominent Experts—an invention that makes Blueprint Reading easy as A B C. Better Jobs and Bigger Pay are now waiting for men who can read Blueprints. If you can read English, YOU can learn to read Blueprints EASILY, QUICKLY—RIGHT AT HOME—IN SPARE TIME, thru this Shortcut, Inexpensive, Sensational New Method. Write TODAY for our FREE book and complete details—DON'T DELAY.

SEND THIS COUPON FOR YOUR FREE BOOK

AUSTIN TECHNICAL INSTITUTE,  
899 Broad Street, Div. P.S.-12,  
Newark, N. J.

Send me FREE, without obligation, your Illustrated Book, "Step Up to a Better Job and Bigger Pay," also full details.

Name.....  
Address.....  
City..... State.....

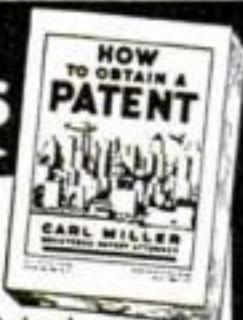
FREE  
ILLUSTRATED  
BOOK  
"STEP UP TO A BETTER  
JOB AND BIGGER PAY"

## INVENTORS PATENT YOUR IDEAS SEND FOR FREE BOOK

### HOW TO OBTAIN A PATENT

Written by a Former Member of the Examining Corps (1922-24) of the U. S. Patent Office. If you want to profit by your idea, you should take steps to apply for a U. S. Patent at once. Your first step is to get this Free Book. This interesting illustrated book contains valuable information you should have. It tells you fully how to obtain a patent on your idea in the quickest way. With this Free Book you will also receive a "Record of Invention" form on which you can easily record your idea. Personal and Confidential Service: Your case will be personally handled only by a Registered Patent Attorney who is also a Former Member of the Examining Corps of the U. S. Patent Office. All communications confidential.

MAIL COUPON TODAY for FREE PATENT BOOK and RECORD OF INVENTION Form.



**CARL MILLER**

REGISTERED PATENT ATTORNEY  
FORMER MEMBER EXAMINING CORPS U. S. PATENT OFFICE

Woolworth Bldg., 35th Floor, Dept. 121-C, New York City  
**MILLER BUILDING**, Dept. 121-C, WASHINGTON, D. C.

Please send me your Free Book, "How to Obtain a Patent," and

your "Record of Invention" form.

NAME.....

ADDRESS.....

L.....

### BE PREPARED! LEARN TO SHOOT WITH BENJAMIN

MADE IN  
U.S.A.



HARD  
ACCURATE SHOOTING  
WITH CHAMBERED AIR



You can use new model BENJAMIN AIR RIFLES WITH LEVER HAND PUMP anywhere, for practice firing or just plinking, around the house or camping, fishing, hunting, etc., at lowest cost. Shooting force is adjustable with amazing maximum power and accuracy—no recoil or forward lunge to disturb your aim. Bolt Action-Hammer Fire-Hair Trigger-Safety Lock-Hand Pump. Single Shot BB with 1 lb. shot \$8.50; Single Shot Cal. 177 or .22 rifled—with 500 pellets \$10.00. Also a complete line of BENJAMIN GENUINE COMPRESSED AIR PISTOLS from dealer or factory. Write for details and FREE TARGETS.

BENJAMIN AIR RIFLE CO., 893 Marion St., St. Louis, Mo., U.S.A.



Learn Profitable Profession  
in 90 days at Home

Earnings of Men and Women in the fascinating profession of Swedish Massage run as high as \$40 to \$70 per week but many prefer to open their own offices. Large incomes from Doctors, hospitals, sanitariums and private patients come to those who qualify through our training. Reducing alone offers rich rewards for specialists. Write for Anatomy Charts and booklet—They're FREE.

The College of Swedish Massage  
30 E. Adams St., Dpt. 970, Chicago

THE DELTA

# POWERlite

AMERICA'S FINEST ELECTRIC LANTERN

800 FEET OF  
PIERCING SPOTLIGHT

• Here's a powerful light for around camp or cottage—for night fishing. Big 4 1/2" front reflector shoots 800 ft. spot beam. Top reflector throws wide floodlight. Either at flip of the switch. Uses a 6-volt battery. Unbreakable lens. \$3.35 less battery at your dealers.

DELTA ELECTRIC CO.  
400 W. 33rd St., Marion, Ind.



## FREE WHOLESALE CATALOG

260 thrilling pages, showing over 4000 opportunities to make money. Household goods, display card items, wearing apparel, cosmetics, foods, jewelry and toys are a few of the thousands of articles shown in this exciting book for salesmen, agents and dealers. Address a postal card to address below and request a copy of this Book of Opportunity, NOW. No charge for it.

Spors Co. 1041 Rice, Le Center, Minn.



## IN EVERY EMERGENCY



there is an element of danger. Does this danger call forth in you the necessity for moral defense? Defense is an attitude of mind. Cultivate the mind, and you will be invulnerable. In an "unlimited emergency," you must keep pace with an unlimited vision of a glorious future and an unlimited experience of vocational expression. Read LEMURIA THE INCOMPARABLE. 60 page book on a New Order and Race. TWO DIMES covers the cost. Don't wait; send your request today to Dept. 49.

LEMURIAN FELLOWSHIP 928 N. PLANKINTON AVE.  
MILWAUKEE, WISCONSIN

## FLUORESCENT WHOLESALE CATALOG

FREE



The most complete fluorescent catalog—listing fixtures, accessories, kits for every type of fluorescent lighting—including newest kitchen and bed lamps—at lowest wholesale prices. New kit and diagram service makes it easy to assemble, install, and sell complete fluorescent for homes, stores, factories, offices and farms. Send for FREE catalog and special agents offer.

Jackson Fluorescent Supplies, Dept. 33, 205 W. Wacker Drive, Chicago

## NEW! MINIATURE DUST MASK



Wear DUPOR No. 1 when sanding, grinding, paint spraying, sweeping, dusting, furnace cleaning, etc. Handy as a pair of glasses. Just keep mouth closed and breathe through nose is all you do to operate. Protects against nuisance dusts, lint, coal, cement, grain dust. Weighs 1 oz. Has 9 sq. in. filter. Book on DUPOR Respirators sent FREE.

H. S. COVER, Dept. PS, South Bend, Ind.

PIONEER RESPIRATOR DESIGNER SINCE 1894

Order Today \$1.00  
POST  
PAID

## READY for CHRISTMAS!



1000-SHOT

**RED RYDER  
CARBINE**

• Write for  
FREE CATALOG

**DAISY AIR RIFLES \$2.95**

DAISY MANUFACTURING COMPANY  
5512 Union St., Plymouth, Michigan, U.S.A.

# POPULAR SCIENCE Classified OPPORTUNITIES



MONEY-MAKING,  
MONEY-SAVING

Classified Ads only 35c per word per insertion, payable in advance. Minimum ad 10 words. To be included in January issue copy should be in our office by November 10th. January issue on sale December 1. POPULAR SCIENCE MONTHLY—351 FOURTH AVE.—NEW YORK CITY

## ADHESIVES

MYTEE-BOND—The Miracle Adhesive—Request booklet. Handy size 30c. Solomon's Laboratories, Long Island City, N.Y.

## ADVERTISING

WRITERS of Sales Letters, Circulars, Ads; enrich your story with vital success ideas; criticism \$3, revision \$5, rewriting entirely \$10. Fast airmail service. Scribes of Inspiration House, Westport, Conn.

MAIL-ORDER or agent ad reaching 1,000,000 families throughout United States \$14.00 inch. Newspaper, magazine, mailing-list, ratebook, free. Chicago Advertising Agency, 20-SP West Jackson, Chicago.

LEARN Advertising at home. Easy practical plan. No text books. Common school education sufficient. Interesting booklet and requirements free. Page-Davis School of Advertising, 1315 Michigan, Dept. 1741, Chicago.

YOUR Ad in Popular Science Monthly will produce profitable business for you. Rate is only 35c a word. Write for details. Dept. A-1, 353 Fourth Ave., New York City.

ADVERTISE: 24 words, 149 newspapers, \$6.50. Lists Free. Advertising Bureau, 4515-P Cottage Grove, Chicago.

24 WORDS, 185 newspapers, \$4.28. Lists free. Fidelity Advertisers, L-3838 Washington, Chicago.

## AGENTS WANTED

DON'T be a Job Hunter—Start your own business on our capital. No hard times; no lay-offs; always your own boss. Hundreds average \$3,000 to \$5,000 annual sales year after year. We supply stocks, equipment on credit, 200 home necessities. Selling experience unnecessary to start. Wonderful opportunity to own pleasant, profitable business backed by world wide industry. Write Rawleigh's, Dept. L-U-PSC, Freeport, Ill.

WANT Agents for your products? An ad in this column will get them for you! Write today for full facts. O. K. Kelly, Classified Adv. Mgr., 353 Fourth Avenue, New York City.

BIG Money applying initials on automobiles. Easiest thing today. Free samples. If you sell printing and advertising specialties we have an excellent sideline featuring Decalcomania Name Plates in small quantities. "Ralco", 727 Atlantic Ave., Boston, Mass.

YOU can make big, quick profits with this 100% personalized line of gorgeous Christmas Folders selling as low as 50 for \$1.00—With Sender's Name Imprinted! Free Spiral-bound sample book! Mode-Craft Greetings, 370A Atlantic Ave., Boston, Mass.

I WILL Give You \$5.00 worth full size packages foods, groceries, soap, etc. Free if you agree to show friends and others. Amazing spare time money making opportunity. Write Zanol, 2318 Monmouth, Cincinnati, Ohio.

AGENTS: Opportunity make money; book containing 127 successful business plans; home-office; send for free introductory booklet, Elite Co., 214-A Grand St., New York.

EARN \$10—\$15 Daily applying beautiful, goldlike Sign Letters. Cost 1c. Sell for 25c. Free Samples. Hurry! Modernistic, T-3000 Lincoln Ave., Chicago.

## BUY BY MAIL

Looking here for mail order bargains is like looking for food at a banquet. It's the natural thing to do! There's many worthwhile opportunities on these pages. You'll find all kinds of attractive buys . . . products and services for your home, car, radio, work shop, camera, hobbies and what not . . . in fact everything you need for your personal, family or business use at low prices.

Please mention POPULAR SCIENCE CLASSIFIED when writing to advertisers. You will be treated fairly and courteously.

WONDERFUL door opener for house-to-house salesmen. Water Misers. 33½% Commission and Money back on unsold items to responsible Agents. See ad on page 244. Economy Value Co.

GOOD Paying business silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. G, Decatur, Ill.

AMBITION School Seniors—Sell Classmates the "tops" in Graduation Name Cards. Best Commissions. Free Cards. Agencies going like wildfire. Hurry! Craft-cards, Box 235-M, Pittsburgh, Pa.

SELL New and Used Clothing from store, home, auto. Men's used shoes 15c, ladies' used dresses 10c. Other bargains. Experience unnecessary. Free Wholesale Catalog. Superior, 1250-MD, Jefferson, Chicago.

IF you are looking for something different, with an unusual sales appeal, low price, good profit, a repeater, and on which you can get exclusive, write us today. World Wide Products, Dept. 16, Littleton, Colo.

SELL New, Used Clothing from Home, Auto, Store. Men's Suits 77c, Leather Jackets 29c, Overcoats 43c, Dresses 10c, Ladies' Coats 33c. Other bargains. Catalog Free. S & N, 565-A Roosevelt, Chicago.

AGENTS wanted to sell all nationally advertised merchandise; commissions to 50%. Write free catalogue "S". Interboro Distributors, 110 W. 34th, New York City.

WILL you give us 5% first \$600 you make? Afternoons free! Work home! \$1,000 month reported (exceptional — fulltime). Expect surprise! National, BX1240, San Bernardino, Calif.

NEW Vestpocket Halex Inhaler just out! On attractive Display Cards. Instantly relieves Head, Nose, Colds, Hayfever Headaches, Sinusitis. Sells itself. Halex Company, Sappington, Mo.

MAGNETIC Sponge draws dirt from clothing. Used like brush. Saves drycleaning. Slick discovery. Samples sent on trial. Write "Inventor", 130 Kristee Bldg., Akron, Ohio.

WINDOW Sign Letters. New "Roman" Style. Large sizes—penny each—absolutely beautiful. Free samples—new catalogue. Atlas, 7941-R Halsted, Chicago.

FREE Circular. Spectacular seller. Rush name. Ward, 97C Saybrook, Conn.

MEN'S—Ladies' Topcoats 35c, Winter Coats 40c, Suits 88c, Pants 23c, Dresses 10c. Other bargains. Catalog Free. Portnoy, 566-W Roosevelt, Chicago.

5th AVENUE Neckties. Big profits. Big assortments. Free sample swatches, sales information. Danforth, 545-Y Fifth Ave., New York.

FREE water and our concentrates make 72 products. We supply labels, bottles. Enormous profits. Qualco, F-20030 Russell, Detroit.

MEXICAN Bird pictures, handmade with real feathers. Sample 10c. Importer, C. Staff, Dept. 16, 14960 Evanston, Detroit, Michigan.

YOU'LL like resilvering mirrors, tableware, making chipped glass nameplates, signs. Write Sprinkle, Plater, 910, Marion, Ind.

AGENTS—300% Profit selling Gold Leaf Letters; stores and offices. Free samples. Metallic Letter Co., 437 N. Clark, Chicago.

DRESSES 10c—Shoes 50c, Coats 75c, Hats 40c. Free Catalogue. Crown, 164-PS Monroe St., New York.

WATCHES, Typewriters, Pens, Cameras, Movies, Violins wholesale, Simmss, Warwick, New York.

FREE! Mexican Curios, Novelties. 100% profit! Marquezi, Apartado 1176, Mexico City.

## AIR CONDITIONING & HEATING

LEARN Refrigeration at home. Simple, easy-to-understand directions for repairing household electric refrigerators. Complete details, diagrams, and photographs. Theory explained in simple terms. Four books, 544 pages, \$4.00 cash or C.O.D. Guaranteed. Refrigeration Library, Dept. 30, 5229 Cass, Detroit, Mich.

OIL Burner easily built from Scrap Parts. Heats large Garage, using discarded crankcase oil. Easy to follow instruction, 50c. Literature Free. Tri State Display Co., Jamestown, N. Y.

FREE Fuel replaces coal. No ashes. True information, \$2.00. Peterson Enterprises, Huntingdon, Pa.

## ANTIQUES, RELICS INDIAN GOODS

12 ARROWHEADS, Spearhead, Wampum, \$1.00. Relics, antique firearms. Catalogue 10c (Photographs of most). Museum, Rutland, Ill.

SWORDS, Rapiers, Daggers, Pistols, Catalog 10c. Robert Abels, 860½ Lexington Avenue, New York.

12 BEAUTIFUL, perfect, prehistoric Arrowheads, \$1.00. Catalog free. Lear Howell, Glenwood, Ark.

25 GENUINE Indian Arrowheads, \$1.00. Catalog. Geo. Holder, Glenwood, Ark.

## ASTROLOGY

1942 SOLAR Forecast, from Now to 1943. 15 pages, 25c Birthdate. Gray, Dept. PSD, 492 Chauncey Street, Brooklyn, New York.

INVESTIGATE scientific Stellar Religion. Sample free. The Rising Star, 3004-A East 13th Street, Wichita, Kansas.

## AUTHORS' SERVICE

NEW Writers Needed! Free Test shows your ability. It's fun! We show what to write, help you sell. Rush postcard. No obligation. Comfort Writer's Service, Dept. 757, St. Louis, Mo.

STORIES Revised, Marketed. Details free. Hursh, Box S-1013, Harrisburg, Pa.

## AUTOMOBILES

**AUTO** Mechanics and Servicemen—MoToR's 600 page 1942 Factory Shop Manual contains 400 tune-up charts, 859 diagrams covering nearly 200,000 vital repair problems on all model cars since 1935. Factory procedures clearly described. Price \$4.00 sent C.O.D., money-back guarantee. Order from MoToR Book Dept., PS-1, 572 Madison Avenue, New York, N. Y.

**UNIVERSITY** test of Whirlgas Turbine proved complete burning of carbon: great reduction in deadly monoxide. Guaranteed mileage increase 20%; power 10%. \$3 any car; give make, year. Wrench installs 15 minutes. John Hanley, Manufacturer, 5719 Loraine, Detroit, Mich.

**AUTOMOBILE** Racing Book, Fifth Edition—Revised. Tells how to build dirt track bodies, frames, engines. Records, superchargers, rules, formula, plans, stock conversions, roadster racing, fast Fords. \$1.00 postpaid; \$1.15 C.O.D. Ray Kuns, Department 263, Madisonville, Cincinnati, Ohio.

**INCREASE** the horsepower of your Ford V8 from 85 to 128 HP—without supercharging. Send \$1.00 for detailed, simple instructions. Power Associates, P.O. Box 501, Wilmington, Del.

## AUTO SUPPLIES & EQUIPMENT

**CONVERT** your car to burn Diesel oil. Save up to 70% fuel costs. Cheap installation. Wonderful performance. Proven factory method. Different and better. Costs nothing to investigate. Write for free circular No. 3, Harrington Company, 201-204 Manchester Bldg., Portland, Oregon.

**BARGAINS**—Welders, compressors, battery chargers, car washers. Liberal trial terms. Write Hobart Equipment, Box P-1213, Troy, Ohio.

**FUEL** oil conversions—For automotive, marine engines. Write for free literature. Houston & Logan, 2112 Addison, Berkeley, California.

**USED** auto parts half price. Cars, Trucks. Century Parts Company, 1712 Lafayette, St. Louis, Mo.

**REFINE** Used oil without cost. Particulars. C. Gerwin, Fairview, Oklahoma.

## AVIATION

**GET** into Aviation! Earn \$2000 to \$5000 a year as Pilot, Mechanic or Aeronautical Engineer. We train you and assist Graduates in locating civilian employment essential to national defense. Big demand. School Government Approved. Write for information. Lincoln Airplane & Flying School, 2106 Aircraft Bldg., Lincoln, Nebr. **BUILD** and fly your own motorcycle powered monoplane, home. Easy, cheap. Tested Plans, guaranteed \$1.00. Aerotech, Box 175, Dearborn, Mich.

## BATTERIES, GENERATORS, ETC.

**EDISON** lifetime storage batteries for light and power. Eliminate acid battery diseases. Long guarantee. All kinds rebuilt generating plants, motors, and miscellaneous articles at bargain prices. Free interesting literature. W. Hawley Smith Company, Croton Falls, N. Y.

**GENUINE** Edison Batteries for power, light. Non-acid, fifteen year life. Five year unconditional guarantee. Low prices. Complete lighting plants. Free literature. See-Jay Company, 87 Sterling Ave., Yonkers, New York.

## BOATS, OUTBOARD MOTORS, ETC.

**MARINE** Power. Easily convert any Ford motor (domestic and foreign) with Osmo Parts and Kits. Complete Catalogue 25c (coin). Osmithson, 3648-P Lawrence St., Philadelphia, Pa.

**OUTBOARD** Motors. Used and Rebuilt. Save money. Used parts. Bargain list free. Crandall-Hicks, 955 Commonwealth, Boston, Mass.

**MARINE** Conversion Parts for all auto engines. Buy here and save. Conversion Parts Co., 277 Adams St., Boston, Mass.

**KAYAKS**. Outboards, Rowboats, Duck Boats. Weldwood ready-cut kits. Catalog I. Cre-Craft Boats, Millburn, N. J.

## BODY-BUILDING COURSES

**WESTERN YOGA**: Unconscious deep breathing prevents disease, makes even old people physically and mentally fit, younger looking. Free folder. Pulmonator Works, 5520 Metropolitan Station, Los Angeles, Calif.

**SNORELIEF**? Husbands! Soldiers! Pulmonator Works, 5520 Metropolitan Station, Los Angeles, California.

**BAR-BELLS**, Dumbbells. Exercise equipment. Courses. Special Offers! Free booklet. Good Barbell Co., Dept. 6, Reading, Pa.

## BOOK MATCHES

**PERSONAL** matchbooks. De luxe blue clay-coat covers. Name stamped in gold. 100 books \$1.00. Planet Co., 8034-T South Marshfield, Chicago.

## BOOKS, PERIODICALS

**TRADE** Magazines. Current numbers. More than 250 different publications to choose from. Books of all publishers on advertising, selling, printing, engraving, etc. Lists Free. Discounts. Commercial Engraving Publishing Co., 345 North Ritter Ave., Indianapolis, Ind.

**MASSIVE** Bargain divisiocatalogs rarest Oriental success secrets. Unobtainable elsewhere. Psychology, Hypnotism, Occultism, Magic. \$1.00. Transcience, Box 37, Chicago.

**ANY** Book, (New, Used, Out-of-Print, Rare) Promptly Supplied! Lowest Prices! Send for Free Bargain Catalogues! Old Prof's Book Shop, S16, Arcadia Court, Pontiac, Mich.

**PRETTY** Girl art photos, books, novelties. Big assortment \$1. Catalog 10c. P. S. Braun, 353 W. 47th, Chicago.

**SNAPPY** books, pictures, novelties, etc. Where to get. We tell you. List only 25c. Esse Co., Dept. A, Baltimore, Md.

**BEAUTIFUL** Art Studies, real art film. Samples and catalog 25c. Shatt Sales, Strasburg, Ohio.

**INTERESTING** Photographs! Male or female models! Books! Ace, 2039 E. 21st, Oakland, Calif.

**100,000 BACK** Date Magazines cheap. List 3c. Book-Magazine Mart, Hutchinson, Kansas.

**RUTHBELLA**—Private Love Diary—deluxe, \$3.50; illustrated, \$2.00. Sample, 25c. 146-V, Palisades Park, N. J.

**GET** Cash for your old books, magazines, catalogues, documents, maps. Horn, Stanwood, Wash.

**STEREOSCOPIC** (three dimensional) Art Photos. Particulars for stamp. Oddity House, St. Petersburg, Fla.

**ART** Studies. 15 large Photos, \$1.50. Catalog 10c. Gross Specialties, B, Carnegie, Pa.

**ART** Photos Interest You? See Capitol Negatives advertisement under Cameras.

## BUILD IT YOURSELF

**BUILD** power Scooters, midget cars. We supply tires, wheels, motors. Lowest prices. Send 10c for plans, etc. Bild-Ur-Own Devices, Dept. 12-B, 536 North Parkside, Chicago.

**PROFESSIONAL** Midget Racers, Two-passenger roadsters, Midget Motorcycles, motorscooters. Parts, plans, wheels. New Handbook catalog—125 illustrations, plans—20c. Midwest, Box 1959-BQ, Chicago.

**MOTORSCOOTERS**. Midget cars! Easily built. Complete plans and literature on wheels, tires, motors, transmissions, etc., 10c. Honsaker, Masontown, Pa.

**BUILD** your own Tractor from second-hand automobile parts and save money. You can't go wrong. Write Nolan's Garage, East Wareham, Mass.

**BUILD** streamlined plywood kitchen cabinets. Plans 25c. Roger Underwood, 4617 Johnson Ave., Western Springs, Ill.

**MIDGET** car and motorscooter building kits, parts, plans. Catalog, 10c. Shipp's Midgets, Box 543-K, Zanesville, Ohio.

## BUSINESS OPPORTUNITIES

**PLASTEX** Industries offer industrious men an opportunity to start a business of their own, manufacturing art goods, novelties and utility products in Plastex and marble imitation. 1/2c material makes regular 10c store seller. Rubber molds furnished for speed production. Small investment brings big returns. We are now placing big Xmas chain store orders with manufacturers. Ambitious men have chance for real prosperity. Plastex Industries, Dept. S, 1085 Washington Ave., New York, N. Y.

**GOOD** Paying Business silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. E, Decatur, Ill.

**MAKE** colorglazed concrete pottery, cemetery products, tiles, floors. Basement waterproofing. Other projects. Booklet, colorplates, details 10c. National Potteries, Minneapolis, Minn.

**WANTED**—men to cast Christmas Goods.

5 and 10c Novelties, Toy Autos, Ashtrays, etc. Can be done in any spare room, basement or garage and no experience necessary. A rare opportunity to devote spare or full time to profitable work. Write Dept. E., Metal Cast Products Co., 1696 Boston Road, New York City.

**BUILD** your own Business. Popular Science

Classified Ads will introduce your products into over 600,000 homes every month. These small ads have built big businesses for many men starting in the mail-order field. Send us a description of your products. We will prepare advertisements and submit them to you for approval. Address Class. Adv. Dept., Popular Science Monthly, 353-E, Fourth Ave., New York.

**MANUFACTURE** new wood plastic gifts, plaques, novelties, 90% profit. We furnish material and rubber molds for big production. Sample mold model large scottie dog, with illustrated molding circular catalogue new flexible molds, 25c stamps or coin. New Era, 1952 Irving Pk., Chicago.

**MECHANICALLY** Inclined Men—Own and operate general Appliance Repair shop. Complete, illustrated course shows you how. Welding, Refrigeration, Motor repair, How to get business, etc., all phases covered. Free literature, Christy Supply, Dept. 311, 2835 N. Central Ave., Chicago.

**START** home business making statuary, plaques; art goods; novelties; souvenirs; concrete pottery; garden furniture; artificial marble flooring; liquid marble. Make your own flexible molds. Amazing profits. Valuable folder free. Creative Publishers, PS-12, Glencoe, Ill.

**MAIL** Order business course shows you how to make money, spare or fulltime. Teaches professional mail order technique—not penny-catching schemes. Free details. Nelson Co., 500 Sherman, Dept. 407-M, Chicago.

**MAKE** Artificial marble, glazed tiles, sanitary flooring, superhard figurines, rubber molds, moldless pottery, chemically stained cement. Uncanny secrets. Samples 3c, expect surprise. Payn, 945 Grande Vista (Room 102), Los Angeles, Calif.

**START** your own business on borrowed capital! Now—without waiting! Don't let money stop you from developing and protecting your ideas. Go into business for yourself! Information sent free. Globe Service, 400 Bellevue, Detroit.

**COLOR** Concrete with chemicals. Stucco-rock, Cement Artistry, Wishing-wells, Spin concrete pottery, Benches, Garden Ornaments, Cold-glaze, concrete-paints, marbling. Sample 10c. Hollywood Cement-Craft, 8530 Wonderland, Hollywood, Calif.

**SENSATIONAL** profits new kind Fluorescent Fixtures screw into socket like bulb. Users save half light bills. Stores, factories installing millions. Rush name for free proposition. Nameo, Dept. C-712, 433 East Erie St., Chicago, Ill.

**"HOW To Make Money With a Duplicator"**, a 20-page booklet just published, will show you how to start profitable mail order business. 25c postpaid. C. O. Olson, 126-B, Grandy, Minn.

**BE** Prosperous. Achieve your ambition. Properly used spare time does it. New folio explains how. 25c prepaid. Money back if not benefited. Business Builders, 435-D Riverside Drive, New York City.

**MAILORDER** Campaigns! Sales Letters! Plans! Expertly prepared. Guaranteed successful. Reasonable. Les Finkel, Advertising, 1013-M South Los Angeles St., Los Angeles, Calif.

**WILL** you give us 5% first \$600 you make? Afternoons free! Work home! \$1,000 month reported (exceptional—fulltime). Expect surprise! National, Bx1240, San Bernardino, Calif.

**METALLIZING** Baby-shoes makes you money! Simple! Novel! Perpetual market. Small investment, fine profits! Full particulars free. Novelty Metallizers, Box 933-S, Church Street Annex, New York.

**MEN!** Women! Plenty of opportunity in plastics and allied products. Add much to present income. Interesting facts Free. Act promptly. Compo-Tex, Box 786-F, St. Louis, Mo.

**127 WAYS** to make money, in home or office, business of your own. Full particulars free. Elite Co., 214-A, Grand St., New York.

PAINT signs for profit, with aid of Lettering Patterns. Free literature. Sample alphabet 5c. Display Letters Company, Box 28-S, Ft. Hamilton Station, Brooklyn, N.Y.

COLLECT Your Share of \$85. Operate Collection Agency—Credit Bureau. Highly profitable. Easily learned. Capital unnecessary. Write, Cole Associates, Syracuse, N.Y.

FREE—200 clever mailorder, homework, local business offers—all snappy money-makers. Lewis Co., 828-K Carpenter, Oak Park, Ill.

LIQUID Marble—Marvelous, colorful! Brushed, sprayed, molded. Rubberlastic molds! Composition Flooring! Particulars free. Marbleizing Service, Edwardsville, Ill.

MOLD plaster novelties. Big profits. Rubber molds and materials. 24-page catalog and sample XL mold material free. Plastics, 711 Neely, Muncie, Ind.

MAKE Belts, Suspenders. Dandy Xmas gifts! No tools! Materials supplied! Sample, 25c. Artsi Leather, 400 Joseph Ave., Rochester, N.Y.

WE show you how to raise capital for any business. \$2.85 postpaid, or write for details. Enterprise Bureau, Syracuse, N.Y.

CHEMICALS convert tin cans into steel scrap, valuable tin. Process, sample, \$1.00. Harry D. Cater, 455 Washington St., Denver, Colo.

SWISS Music Box Works—\$1.25 to \$2.10. Suitable for many novelties. Mermad Manufacturers, 147 West 46th St., New York.

WHERE to buy at lowest wholesale prices. Information free. Yorena, Box M-312, Bayonne, N.J.

HANDY men—Earn money home operating Community "Fix-It" Shop. Stafford, 708 Rawlings, Carbondale, Ill.

OPERATE a profitable mail order business in spare time at home. Particulars free. Thos. L. Troxell, Dushore, Pa.

REAL Manufacturing Formulas. Particulars free. Chemist, 228 Gordon Avenue, Syracuse, N.Y.

TURN Tin cans into money. Instructions 25c. Chaney, 1130 E. 16th St., Jacksonville, Fla.

\$50—\$100 WEEKLY using Sawdust. Stamp appreciated. Clement, 843 Arthur, Rochester, N.Y.

START Lettershop In Home: Splendid Profit: Details: PSM-Lettershop, Maudeira, Ohio.

READ "Common Sense in Mailorder". Free details. Hayes, Box 1433-Q, Oakland, Calif.

RAISE Angora Rabbits—wool brings \$5.00 pound. Particulars free. Grinstead, Carrollton, Ill.

HOW and where to obtain capital. Particulars free. Star Service, Wapakoneta, Ohio.

HOW to Sell services by small profitably. Aristo, C. Plainfield, N.J.

#### BUSINESS SERVICE

HOLLYWOOD or Los Angeles mail address, Business or Personal, \$1.00 a month. California Information Service, 4575 Santa Monica Blvd., Hollywood, Calif.

WANT more business? Advertise your product or service in these columns. For details, write today to O. K. Kelly, Classified Adv. Mgr., 353 Fourth Ave., Dept. BS, New York City.

WE Collect Notes, Accounts everywhere. No charges unless collected. May's Collection Agency, Somerset, Kentucky.

#### CAMERAS, PHOTO SUPPLIES

WRITE Bass First—Largest stocks of fine cameras, (still and movies) in the U.S.A. Latest Argus C-3 with coupled range finder, synchro flash, 50mm. F:3.5 lens; also 75mm. Bausch & Lomb Telephoto F:5.6, also coupled to range finder. \$82.55 value, price—\$60.50, unconditionally guaranteed. Cowhide Eveready case, \$4.75. V.P. Ihagee, F:4.5 Anastigmat, Prontor shutter, \$16.75. Whatever you want in photography, write Bass first. Liberal trades. For over thirty years, money back if not satisfied. Bass Camera Company, Dept. S.P., 179 W. Madison Street, Chicago, Ill.

HAVE You a Camera-Kodak? Use it for Profit as well as pleasure. Good snapshots are salable. \$50.00 to \$200.00 per month possible. Booklet, with one-hundred best markets tells you how. Send 50c Money Order, no stamps. Address, Hinrichs, Carrollton, Ill.

CAMERAS and supplies. Free illustrated catalog listing everything photographic—still and movie cameras, films, lenses—at tremendous savings. Hundreds of bargains, new and used. All guaranteed. We take your old cameras or equipment in trade. Write now for your free copy of our newest money-saving bargain book—just out! Limited edition. Hurry! Central Camera Co. (Photographic Headquarters since 1899), 230 S. Wabash, Dept. L-18Z, Chicago, Ill.

AMATEUR Photographers attention! Improve your hobby of picture taking and learn how to make money with it. Write today for our 40-page book catalog and a sample copy of American Photography, enclosing ten cents for postage. Contains articles and pictures of the world's foremost writers and pictorialists. Camera House 141, 353 Newbury St., Boston, Mass. OIL coloring photographs a fascinating hobby or profitable business. Learn at home. Easy simplified method. Previous experience unnecessary. Send for free information and requirements. National Art School, 1315 Michigan, Dept. 1747, Chicago.

PHOTOGRAPHY is a leading hobby of Popular Science readers. This column offers an economical way to reach them. Advertise your product here and get more business! Classified Adv. Dept., 353 Fourth Ave., New York City.

MAKE money in photography. Learn quickly at home. Easy plan. Previous experience unnecessary. Common school education sufficient. Booklet and requirements free. American School of Photography, 1315 Michigan, Dept. 1741, Chicago.

The same advertisers will be found in this Classified Section month after month and year after year. Reason—*Popular Science Classified Advertising Produces Profitable Results!*

For full details, write  
Classified Advertising Department

POPULAR SCIENCE MONTHLY  
353 Fourth Avenue, New York City

ART Photo Enlargements—make your own prints of beautiful girl models from our 35mm fine grain negatives. Large assortment \$1.00. Details 10c. Capitol Negatives, Box 507, Washington, D.C.

SPEED-O-COPY groundglass focusing attachment for Leica, Contax, Argus C-2 and C-3. Send for literature. D. Paul Shull, Dept. PS-12, 240 So. Union Ave., Los Angeles, Calif.

MAKE Money with your camera. Full details, fifteen different methods, for wrapped quarter. Kentner, 363 Alexander, Rochester, N.Y.

35MM BULK Film! 25 ft. Eastman Plus X \$1.00! Reloaded Cartridges—3 for \$1.00 postpaid. Order now. Pacific Coast Film Co., 1510 N. Sierra Bonita, Hollywood, Calif.

CAMERA Repairing. Bellows made to order, shutters repaired. Bellows made to fit, all standard cameras! United Camera Co., Inc., B-1515 Belmont, Chicago.

SOLAR Enlargers for Prize Winning Prints. Amazing performance. Enlarging Treatise free. Ask your dealer. American made by Burke & James, Chicago, Ill.

"DIFFERENT" home movies. Sample, catalog, dime. Bantam, Room 933, Michigan-OHIO Building, Chicago.

#### CHALK TALK STUNTS

LAUGH producing program, \$1.00. Illustrated catalog 10c. Cartoonist Balda, Oshkosh, Wis.

#### CHARTERS

DELAWARE charters; complete service \$35.00. Submitted forms. Chas. G. Guyer, Inc., Wilmington, Del.

#### CHEMICALS & APPARATUS

MONTHLY Chemistry Magazine, 6204-N Hermitage, Chicago. Year, 75c; Sample, 10c.

CHEMISTRY Laboratory apparatus and chemicals for industrial, analytical, and experimental laboratories. Complete supply service for students taking correspondence school chemistry courses. Send 3c postage for free 44 page catalog. Dept. M26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester, N.Y.

HANDBOOK for Chemical Experimenters. Hundreds of experiments, illustrated, 50c. Experiment booklet with chemical catalog, 10c. Reading Scientific Co., Reading, Pa.

YOUR chemical problems solved. Any formula tested, developed. Confidential. Reasonable charges. Chemical Engineering Associates, West Hartford, Conn.

LUMINOUS Paints will glow in dark. Five colors. Fairmount Chemical Co., 126 Liberty St., New York City.

BOOKLET. Plant Experiments. Soilless. Colchicine. Send stamp. Questop, Wellesley, Mass.

CHEMISTS. Chemical questions answered. \$2.50. Formulas, analyses. Lewitsky, 26 Erwin Place, New Britain, Conn.

FREE Catalog: Chemistry, mineralogy, biology, microscopes, telescopes. Tracey Laboratories, Evanston, Ill.

CATALOG 3000 Illustrations 10,000 prices. Sent for 50c. Laboratory Materials, 7317 Vincennes, Chicago.

25 RESISTANT Test Tubes, metal holder, experiments, 39c. Scientific Exchange, Brooklyn, N.Y.

SPECTROSCOPE for quick chemical analysis \$2.50. McCutting Sons, Campbell, Cal.

CHEMICALS in 5c quantities. Catalog 5c. Fleischer's Laboratories, Medford, Mass.

#### DETECTIVES

DETECTIVES—Work home—Travel. Experience unnecessary. Write, Wagoner, 2640-P Broadway, N.Y.

#### DOGS, BIRDS, PETS

ST. BERNARDS—all breeds—details free! Book 104 photos, descriptions recognized breeds 25c. Royal Kennels, No. 80, Chazy, N.Y.

PIGEONS. Christmas gift, reasonable prices. Vasta, 1411 S. 12th, Philadelphia, Pa.

ST. BERNARD puppies. Champion sired beauties A.K.C. Franklin Young, R3, Riverhead, Long Island, New York.

#### EDUCATIONAL & INSTRUCTION

BIBLICAL Dietary Formula for World Peace and Everlasting Life revealed. Note: Pigs eat garbage and field rats. Rabbits are rodents. Shell fish are sea scavengers. Don't sin like Adam-Eve by eating forbidden food. Health Book, 100 pages, twelve cents. Dr. Deerbos, Box 41, Sta. A, Brooklyn, N.Y.

LEARN Welding! Get into aircraft, shipbuilding, hundreds of important industries that need trained welders. Prepare now for good pay and future. Learn spare time at home if preferred. Write for Free facts. Utilities Engineering Institute, 1314 Belden, Dept. 31Z, Chicago.

WELDING—Electric Arc. Learn quickly by actual practice at Hobart Welding School. Individual instruction at bare cost of materials used. 50c in stamps brings valuable welding lessons post paid and full particulars, Hobart Welding School, Box P-1214, Troy, Ohio.

IMMEDIATE Openings for arc welder students in expanded famous Lincoln school. Big opportunity for learning arc welding. Now in big demand. Bright future. Write Lincoln Welding School, 12818 Coit Rd., Cleveland, Ohio.

LEARN Telegraphy! Splendid opportunities now prevail. All expenses low. Catalog free. Dodge Institute, Harmon Ave., Valparaiso, Ind.

BE a doctor. Learn chiropractic. Fast growing profession. Write for catalog. Dept. C., Texas Chiropractic College, San Pedro Park, San Antonio, Texas.

ENJOY Health. Become Professional Equestrian. Free health book. Write Emil Knoff, 2154SH North 52nd St., Milwaukee, Wis.

CLINICAL Laboratory Technic taught in your own home. Practice outfit supplied. Bulletin free. Imperial Technical Institute, Box 494-B, Elkhart, Ind.

LEARN to be a Notary Public, make money, big opportunities legal field. Short course. Booklet. Institute, H-30W, Washington St., Chicago.

PART Time Bookkeeping pays big. Fifteen lesson course. Fireside Educational Institute, 5542-M, South Homan, Chicago.

AVIATION Radio Training \$79.00. Many Jobs. Universal Television, Kansas City, Mo.

BLITZKRIEG to success! Learn all, write 'CO' Info, Box 1122, Chicago.

#### ELECTRICAL SUPPLIES & EQUIP.

ELECTRIC Pencil, famous Professional model, guaranteed, sold on approval. Favorite of 5 & 10 demonstrators. Engraves small, medium, wide lettering, gold or silver on almost any material. Safe to use continuously. Switch on seven-foot safety cord, with roll superior gold, \$4.75. 2 rolls gold 1" x 400" \$1.00. R. E. Stafford, 2434 N. Meridian, Indianapolis. (We originated the Practical Electric Pencil in 1931).

\$7.50 UNIVERSAL Tester made by Standard Transformer Corp. for any ordinary lamp, bulb, or fuse (no radio tubes) regardless of voltage or type base. 3 yr. guarantee. A Must in hardware, appliance stores, and service stations. Free literature. \$3.45 cash or C.O.D. Irvin I. Aarons, 4028 N. 16th St., Milwaukee, Wis.

ELECTRIC Pencil: Writes—Engraves all Metals. \$1.00 postpaid. Beyer Mfg., 4515-C Cottage Grove, Chicago.

FREE 1941 Catalog. 1000 electrical bargains. LeJay Manufacturing, 823 LeJay Bldg., Minneapolis, Minn.

FLUORESCENT lights save  $\frac{1}{2}$ . Catalog Free. J. Millar, 1424 Jackson, Chicago.

#### ENGINES, MOTORS, ETC.

$\frac{1}{2}$  HORSE, 3450 Speed, Repulsion Induction Alternating Motors, \$10.75; 500 Watt Alternating Generators, \$24.50; other sizes. Butler Electric, 1865 Milwaukee, Chicago.

GUARANTEED Rebuilt motors. New drills; grinders; home workshop tools. Bargain pricelist. Mailorder Electric, 705 South Dearborn, Chicago.

$\frac{1}{2}$  HORSE, 110 volt, induction motors. Rebuilt, guaranteed \$8.75; other sizes. Wilmot Auto Supply, 2247 St. Paul Ave., Chicago.

AIR Compressors  $1\frac{3}{4} \times 1\frac{3}{4}$ , \$6.00; 2x2 \$7.00;  $2\frac{1}{2} \times 2$  \$8.00; Electric drills  $\frac{1}{4}$  in. \$5.95. Free Folder. National, 1915 S. State, Chicago.

MOTOR Winding Data, selection single and three phase, \$1.00. Motor Data, Box 7631, Kansas City, Mo.

BARGAINS—Welders, electroplating, motor generators, guaranteed, liberal terms. Write Hobarts, Box P-1211, Troy, Ohio.

#### FARMS, OTHER REAL ESTATE

GOOD Farm Bargains. Washington, Minnesota, Montana, Idaho, Oregon, North Dakota. Dependable crops, favorable climate. Write for literature and lists describing typical farms for sale. Specify state. J. W. Haw, 120 Northern Pacific Ry., St. Paul, Minn.

ON River, In Village—Dandy little place for sportsman farmer; 35 acres, about 15 tillable; good dwelling 7 rooms; only \$2300, terms; picture page 47 big Free catalog 1290 bargains many States. Strout Realty, 255-ZB 4th Ave., New York City.

SEE The Highlands of Louisiana. Choice cut-over land selling on liberal terms. Descriptive book sent upon request. Long-Bell Farm Land Corp., 874 R. A. Long Bldg., Kansas City, Mo.

40 ACRES, near White River, unimproved; poultry land, \$190; \$5 down, \$5 monthly. Free list and literature. Hubbard, 269 Grossman Bldg., Kansas City, Kan.

#### FIELDGLASSES, TELESCOPES & MICROSCOPES

LENSES—Build your own telescope, field glass, microscope, riflescope, etc. Assortment of fifteen lenses—\$1.00 postpaid. Slightly chipped on edge. Satisfaction absolutely guaranteed. American Lens Company, 324 N. Mayfield, Chicago.

TELESCOPES, Microscopes, Binoculars; bargain catalog free. Brownscope Co., 125 West 45th St., New York.

#### FOR THE HOME

EXTRA Large beautiful, pink, white sea shell, 10" x 11". Prepaid \$1.00. Shells, Box 3494, Jacksonville, Fla.

VACUUM Cleaners—New and Rebuilt; Parts, Attachments. Lowest Prices. Vaco. P.O. Box 81, Clifton, N. J.

#### FOR INVENTORS

INVENTORS—Delays are Dangerous—Secure patent protection now. Get new Free booklet, "How to Protect Your Invention." No charge for preliminary information. McMorrow and Berman, Registered Patent Attorneys, 1432 Barrister Bldg., Washington, D. C.

INVENTORS: Take first step toward protecting your invention—without obligation. Send for free "Record of Invention" form—and free "Patent Guide" containing instructions on how to patent and sell inventions; details of search service; convenient payment plan. Write today. Clarence A. O'Brien, Registered Patent Attorney, 1M2A Adams Building, Washington, D. C.

INVENTORS: Unpatented inventions now salable with positive safeguards under patent laws. New, low-cost procedure. Complete details, free. American Patents Corporation, Dept. 12, Washington, D. C.

INVENTORS—We develop your ideas, design, build models, furnish parts and tools or manufacture for you. General Engineering and Model Works, P.O. Box 109, Covington, Ky.

HAVE you a sound, practical invention for sale, patented or unpatented? If so, write Chartered Institute of American Inventors, Dept. 3-A, Washington, D. C.

CASH for practical ideas and inventions. Mr. Ball, BB-9441 Pleasant, Chicago.

#### FORMULAS, PLANS, ETC.

AUTHENTIC Formulary. 924 pages. (Illustrated.) Recipes, instructions—10,000 profitable products. \$1.50 postpaid or C.O.D. (Foreign \$1.85.) Catalog 3c. Adams-Brown, Chestnut Hill, Mass.

MILLARS' Free Formula Messenger shows you interesting, easy way earning wonderful profits—building big business, making largest-selling Profitable Necessities! Millars' Chemists, Tampa, Florida.

NEW! Foaming (Soapless) Formulas. Also one ingredient formulas—no manufacturing! Information free. C. Kinford, Wayne, Pa.

SIMPLIFIED Formulas—Newest kind. Surprising literature free. Baran, Bay City, Michigan.

FORMULAS—Latest, best. Analysis. Literature free. E. Belfort, Engineering Bldg., Chicago.

MASTER Formulas, all lines. State requirements. Chemical Service, Richmond, Va.

FORMULAS. All kinds. Guaranteed. Catalog free. Kemico, 500, Parkridge, Ill.

#### HELP WANTED

MEN Wanted—Auto-Diesel Mechanics. We pay your railroad fare to Nashville. Let us train you to be an expert mechanic and help you get a good job. The cost to you is small. For free booklet write Nashville Auto-Diesel School, Dept. 269, Nashville, Tenn.

STEADY Work—Good Pay. Reliable man wanted to call on farmers. No experience or capital required. Pleasant work. Home every night. Big Money every day. Some making \$100 in a week. Wonderful new proposition. Particulars free. Write McNess Co., Dept. 552, Freeport, Ill.

HOW To get a job! Thirty model application letters, information on interviews, and sources of available positions. \$1.00 postpaid. Guidance Service, Box 175, Crosby, North Dakota.

AT home, your own manufacturing business, making popular \$1.00 novelties. Cost you 3c to 15c. Everything supplied. Write So-Lo Works, Dept. D-824, Cincinnati, Ohio.

MAKE \$1.00 an hour, year round, full or spare time, entirely by mail. Details free. Reliable, Box 182, Springfield, Ill.

LEARN Sign Making, showcard writing, new easy way sell stores. Details free. Simon, R.I.B. 148, Greenville, Ky.

#### HIGHGRADE SALESMEN

ADVERTISING Book Matches—World's largest "Direct Selling" Book Match Factory offers advance cash earnings calling on every type of business. Experience unnecessary; full, part time. Low prices for high quality; quick deliveries, help you get orders. Good repeat profits. Free kit, Instructions. Match Corp. of America, 3433 West 48th Pl., Dept. N-12, Chicago.

DISTRICT Representatives—permanent territory, a business of your own—by LaSalle Extension University, a correspondence institution. Thoro training, much national advertising, liberal commission. Requirements—good personality, ability to counsel with prospects, will to work, a car. John D. Morris, 4111 S. Michigan, Chicago.

MAN with car to establish retail store route. Openings almost every locality. Handle orders for nationally known manufacturer-jobber. Average 50% commission. Steady big pay opportunity. Sales experience unnecessary. World's Products Co., Dept. 83-V, Spencer, Ind.

BIG money daily. Sell business stationery, advertising specialties, book matches, gummed tape, 700 other necessities to stores, offices, professional men. 33 1/3% profit paid daily. Biggest, best line of its kind. No experience needed. Big outfit free. Willens, 2130 Gladys, Dept. 712, Chicago.

GREATER Christmas Profits! Fifty Imprint Cards 20c! Dollar Box Assortments 33c! Calendars, Wreaths, Pictures, Novelties! Catalog Free! Fantus, 440 N. Wells, Chicago.

CALENDARS—Beautiful Complete Line all sizes, including Jumbos. Samples free. Start now, be the first in the field. Fleming Calendar Co., 6539 Cottage Grove, Chicago.

YOUR ad in this Classification will reach productive sales-getters for your products or services. Rates on request. Popular Science Classified, 353 Fourth Ave., New York, N. Y.

MAKE more money selling Red Comet Fire Control Products. Write today for free facts. Red Comet, 744 Comet Bldg., Littleton, Colo.

BLADES—Big profits. Best quality. Factory prices. Postpaid. Ace Blades, Buffalo, N. Y.

#### HOBBIES, COLLECTIONS

RAILPANS—Send 25c now for current copy of Trains, excellently illustrated monthly magazine about railroads and railroad travel. Trains, 1572 W. Pierce, Milwaukee, Wis.

MAKE Novelties from sea shells. Enormous profits. Ideal Xmas gifts. 20 assorted prepaid, \$1.00. Novelty Shells, Box 3494, Jacksonville, Fla.

BEAUTIFUL assorted Jewelry Stones, (new) 200 for \$2.00 postpaid. Moore's, 651 S. State, Chicago.

#### HOME CRAFTSMEN

28 LAWN Ornament patterns 25c. Other patterns: 15"-20" high; Dutch girl, Dutch boy, pirate, bull terrier, Mexican girl, Mexican boy, dwarf, penguin, flower girl, 10c each; 3 for 25c. 25 Novelty patterns. 30c. All 62 full size patterns \$1.00 postpaid. Strother, Box 383-DB, Belington, W. Va.

SQUARENOTTERS! Make belts, handbags, etc. Quality cord samples with catalog free, beginner's book, catalog and samples, 10c. Special! Regular \$1 book with 50c beginner's outfit, all for \$1. P. C. Herwig Co., Dept. P-35, 121 Sands St., Brooklyn, N. Y.

NEW Pattern & Supply Catalog. Plywood Novelties, Lawn Ornaments, Silhouettes, Decal Transfers, Letter & Numeral Patterns, Handy Hand Tools, New Power Sander, other Lines. 500 articles finely illustrated. Write today. The Wo-Met Shop, Ashburn, Georgia.

FURNITURE, Professional Designs for house and lawn, "actual size transfer patterns". Wood bleaching and cushion making instructions. Catalog 10c. Craftsman Design Service, Dept. D1, Berne, Indiana.

TO get more business, advertise your projects for Home Craftsmen in this column. Details on request. O. K. Kelly, Classified Adv. Mgr., 11th floor, 351 Fourth Ave., New York City.

GET Free leathercraft instruction pamphlets, prices of leathers, tools, projects. Fascinating Hobby. Make gifts. Leather samples 5c. Wilder & Company, 1038 Crosby, Dept. A-12, Chicago, Ill.

LEATHERCRAFTSMEN: Send 10c for handbook and catalogue of tools and supplies. E. A. Sweet Co., Inc., Leathercraft Division S-17, 148 State St., Binghamton, N. Y.

VENETIAN Blinds, supplies, machinery, wholesale. Catalog 10c. "Manufacturing Booklet" \$1.00. "Roberta", Box 260, Gloversville, N. Y.

LEATHER Craftsmen: Xmas gifts. New outstanding projects, ideas. Free catalog. Artcraft Leather, 400 Joseph Ave., Rochester, N. Y.

KNOCKDOWN Cedar Chest, Foreign and Domestic Veneers, Lumber. Catalog 10c. Giles, Kendall Co., Decatur, Ala.

MEXICAN Novelties easily made! 20 patterns complete instructions 25c. Mexican Artercrafts, Eagle Pass, Texas.

1000 TELUHOW Plans. Explained. For homecrafters of all ages. Classified list. 10c. C. King, E. Kingston, N. H.

ANTIQUE Firearms, Indian Relics. Catalogues 10c (Photographs of most). Museum, Rutland, Ill.

VENETIAN Blinds and Supplies. Literature Free. Homecraft Supply, Aurora, Ill.

## HUNTING

HUNDRED Hunting Hounds Cheap, catalogue. Elton Beck, D-39, Herrick, Ill.

## INVENTIONS WANTED

WANTED immediately, ten practical inventions, patented or unpatented. Mail full details. Strictly confidential. Invention-Service Company, Dept. B, Professional Arts Building, Hagerstown, Md.

SIMPLE, practical inventions wanted by manufacturers, patented or unpatented. For information write Chartered Institute of American Inventors, Dept. 3-C, Washington, D. C.

SMALL inventions wanted by manufacturers. I'll help you sell your invention. Write for free circular. S. Hull, 7829-M Euclid Ave., Cleveland, Ohio.

INVENTIONS Promoted. Patented or unpatented. Write Adam Fisher Co., 183-A Enright, St. Louis, Mo.

CASH for Inventions—Patented or unpatented. Mr. Ball, BC-9441 Pleasant, Chicago.

## JEWELRY

GENUINE diamonds, out-of-pawn prices. Liquidating unredeemed loans and distress merchandise. One carat \$95.00,  $\frac{1}{2}$  carat \$42.50,  $\frac{1}{4}$  carat \$21.75, men's or ladies' rings. Send for complete list. Prudential Loan Association, 133 N. Clark, Dept. F-12, Chicago.

## LEGAL DIRECTORY

MEXICAN Legal matters, Wm. Cocke, Reliable Amer. Atty., El Paso, Texas.

## MACHINERY, TOOLS & SUPPLIES

BUILD your own machine tools. Lewis furnishes semifinished castings for Bench Milling Machine and Shaper; rough castings for 23 metal and woodworking tools. Shop-tested materials and professional blueprints. Never a complaint on quality, design or price! Send 10c—New 1942, 32 page illustrated catalog. Lewis Machine Tool Co., Dept. S-12, Box 116, Station A, Los Angeles.

PROFIT from defense demands. Equip your shop with quality machine tools. Machine your own. Shop tested. Bench miller, Bench punch press,  $\frac{1}{2}$ " sensitive drill press. Completely detailed blue prints and hi-grade castings. Prices on prints, castings or both on request. Jarrett Engineering Co., 6 West Armour, Kansas City, Missouri.

THE New Shebel Saw Filer produces saws that have no equal. Send for full information. A. P. Shebel, 726 S. 2nd St., Milwaukee, Wis.

SURPLUS of Used Claw Hammers. Grade A. Factory Redressed. 52c. Niles Tool Service, Niles, Ohio.

DRILL Grinding attachment, price \$8.85, used with bench grinder. Literature on request. Tractor-Lite Co., Sidney, Iowa.

AIR Compressors Twin cylinders \$8.00.  $\frac{3}{8}$ " Electric Drill, \$10.00. Sewing machine motors, \$2.50. 907 North Fifth, Philadelphia.

MAMMOTH Workshop: Ten Machines. Motor—\$74.50. Machine Service, Newfane, Vermont.

## MAGIC TRICKS, PUZZLES, JOKER NOVELTIES

TRICKS you can do! For Pocket, Parlor, Stage. With coins, cards, cigarettes, ropes, balls, thimbles, apparatus. Magical books, illusions. Send 10c for latest 100 page Catalog of 500 Tricks, which includes Free 10 selected Pocket Tricks. Send 10c today. Douglas' Magicland, Dallas, Texas.

HOUSE of 1000 Mysteries! Famous coast to coast! Professional Magic! Tricks! Joker's Novelties! Two big catalogs combined into one Giant Edition! 600 illustrations! Only 10c. Vick Lawton, Dept. P-72, Queens Village, N. Y.

WORLD'S largest professional magic shop keeps you in touch with latest tricks. To receive mailings send 25c for 1941 catalog. Holdens, P-220 W. 42nd St., New York.

HOLLYWOOD Special! Magicians button, catalog, ghost illusion and free trick for 25c. Magic House of Charles, Box 8888, Hollywood, Calif.

MAGICIANS' Gamblers' Secrets Exposed (one-volume book) 30c with Free Magic Catalog. Book Co., Box 671, St. Louis, Mo.

FREE Trick and Professional Magic Catalog 25c. St. Louis Magic Studio, 418 Olive, St. Louis.

BULLETIN, Samples, 10 Tricks, 25c. Magic at wholesale. Ivan, 104 Grand St., Brooklyn, N. Y.

MAGIC. Novelty catalog, three gifts, 10c. Frank Wencel, Hamtramck, Mich.

MAGICIAN'S Headquarters. 216-page Illustrated catalog, 25c. Kanter's, S-1311 Walnut, Philadelphia.

JOIN Magicians' Fraternity! Free Tricks! Monthly Magazine, sample 10c. International Magicians, Mount Morris, Ill.

BE A Magician. Large professional magic catalogue of latest tricks, 25c. Ireland, F-109 North Dearborn, Chicago.

## MANUFACTURING

MANUFACTURING any material, any quantity, inventions developed. Millburn, Burlington, Ky.

## MINERALS & PRECIOUS STONES

GEMS, Agate, Minerals, Jewelry. Six rough gemstones—Emerald, Sapphire, Garnet, Topaz, Fireopal, Agate. \$1.00 postpaid. Catalog. Hill Co., Route 7-K, Salem, Oregon.

THREE Zircons genuine \$1.75. Alexandrites syn. from 3 carats up. \$1.25 per carat. Lowe's, Box 525, Chicago, Ill.

## MISCELLANEOUS

DRUG Sundries, specialties, supplies, etc., mailed directly by manufacturer. Send for free mail-order catalog, saving 75%. Mail-Order, Dept. 5A, Box 231, Hamilton, Ontario.

PRETTY Girl Pictures New Series postcard size, complete set 30 pictures \$1.00. 12 for 50c. Sample Package 25c. Satisfaction guaranteed. Harlem, 311 W. 125, Box 10, New York, Dept. A-8.

DEAFNESS. Why? Good hearing without mechanical aids. No drugs. Relieving deafness. Johnston, Sta. C, Vancouver, Canada.

COMIC pen and ink sketch made from your photograph. Picture returned unharmed. State hobby or pastime. Send photo and \$1 to Oveta Burleson, Jewett, Texas.

COFFEE—3 lbs. Colombia Blend, Tea, Pekoe, Ceylon,  $1\frac{1}{2}$  lb., \$1.00. Vermont Maple Syrup, \$3.50 gal. Cargo-Sales, 829 Broad, Newark, N. J.

HARNESS the sun. Heat all the hot water you can use without heating cost; easy to build. Information free. Sol-Ray, Daytona Beach, Florida.

DOCTOR I. Q. Radio Fans—Mail dollar (no stamps) for new statements never used on this program. E. F. Dunlap, Derby, Iowa.

RECEIVE gigantic mails, magazines, samples. Your name in numerous mailing lists 10c. Howard, 396 Broadway, New York.

SOLVE problems through prayer. Ontology shows how. Particulars free. Alexander Keene, D-851 South State, Chicago.

FREE literature how to locate buried treasure and minerals. Fisher Laboratory, Palo Alto, Calif.

CHRISTMAS Gift! A Frazier Clam Opener, \$3.50. 1509 N. Park Ave., Philadelphia, Pa.

"PRESS Cards"—"Tags"—Supplies. Press Supplies, 1934 Eleventh, Washington, D.C.

MILLIONS Await Missing Heirs! Lists, details, 10c. Dueffey, Covington, Ky.

I HEAT six rooms \$20 yearly. Information 10c. Rosenzweig, Route 10-B2, Cincinnati.

## MODELS & MODEL SUPPLIES

FREE! New Big catalog of record breaking models. 52 picture packed pages, drawings and other information makes this a modeler's reference book. Includes airplanes, speed boats, race cars, radio control. Enclose 10c handling charge. Berkeley, Dept. PS, 230 Steuben Street, Brooklyn, N. Y.

SAVE Money—get quick service direct by mail. Every Model Railroader should have our big new 36 page 1942 catalog before purchasing. Catalog ten cents. Model Railroader Shop, Dept. PS, Dunellen, New Jersey.

BUILD a model railroad. Best plans and construction articles are in Model Railroader Magazine. Send 25c now for current copy. Model Railroader, 1562 W. Pierce, Milwaukee, Wis.

GUNSMITHS. Experimenters. Model-makers—send 10c for 44 page tool and supply catalogue; many special tools listed. Mittermeier, 3577 E. Tremont, Bronx, N. Y.

POWER Models. Railways, traction engine, steam and gasoline engines, all accessories, metals, tools. 84 page catalog, 35c. Charles Cole, Ventura, Calif.

SCALE Model Airplane and Railroad Kits. Circulars Free. Hobbycraft, 2209 E. 75th, Chicago.

MODEL racing Cars: Three Plans, 25c. Northern Aircraft, Manitowoc, Wis.

MOST complete Illustrated Catalog—"O-HO OO" Model Railroad Parts ever published. Send 5c for mailing. Selly, 1377 Gates Ave., Dept. 812, Brooklyn, N. Y.

SPEEDBOAT 20"x7" completely prefabricated kit. Mahogany trim. Propeller, tube, rudder, plans and instructions \$3.95 postpaid. "Bermoco", Berwyn, Md.

IMMENSE Mini-Train railroad catalog! 52 pages. Send 25c. Vanden Boom's, 3827 Broadway, Kansas City, Mo.

MODELMAKER'S Knife; extra keen. Ebony, cocobolo handle. 60c postpaid. "Bermoco", Berwyn, Md.

LATEST Engine Catalog 25c. Refunded. Howardco, P-2417 North Ashland, Chicago.

SHIP Model and yacht supplies, complete large 56 page Catalogue, 15c. Wm. Wild, 510 E. 11th St., New York City.

MODEL Airplane Kit, 25c. Idle Hour Hobby Service, Shillington, Pa.

## MONEY MAKING OPPORTUNITIES

BE A Metascientist. Remarkable drugless healing system. No manipulation, no apparatus. Inexpensive correspondence course. Free information. Metascience, DeLand, Florida.

BE a professional scrapbooker. Big fees. Unlimited opportunities. Can be done at home. No competition. No capital needed. Write to Scrapbookers Guild, 62 Park Place, New York, N. Y.

YOUR name on 5,000 mailing lists—25c. Get free samples, opportunities, galore from all over world. Eastern, S-961 46th, Brooklyn, N. Y.

10 DOLLARS Daily. Assures your independence. A marvelous discovery. Information 25c (not a fraud). E. P. Behnen, Deaver Lane, Creve Couer, Missouri.

300 TESTED Moneymakers, 64-page book, 40,000 words. Business secrets, formulas, wholesale supply sources galore. 25c. Scott's, Box 342, Covington, Ky.

EARN money evenings, copying, duplicating cartoons for advertisers. Adservice, Argyle, Wis.

BIG Mail and Opportunities. Send 15c. F. R. Clark, R.D. No. 1, Hagaman, New York.

EARN Money taking magazine subscriptions. New York Circulation, 30 Church, New York.

OPPORTUNITIES Galore, giant mails 10c, sample mailing free. Harvey Teeple, (PS), Decatur, Ind.

CO-PUBLISH national humor magazine. Your advertising free. Copy 10c. 715E Haas Building, Los Angeles.

BOOKKEEPERS (experienced) for profitable accounting work. Ralph Lee, Vicksburg, Michigan.

YOU'LL like resilvering mirrors, tableware, making chipped glass nameplates, signs. Write Sprinkle. Plater, 920, Marion, Ind.

## MOTION PICTURE & SOUND EQUIPMENT

SOUND, Silent; Cameras, projectors, lenses, screens; half price. Installments, trades accepted, bought. Catalogs. Rental library films sent anywhere. Mogull's, 66 West 48th St., New York City.

MOVIE Film 100' 16mm \$1.50, Nonhalation \$1.98. Weston 32, \$3.19, Weston 100, \$3.89, 25' double 8mm, 98c; processing included. Ambassador, 479-A Quincy Street, Brooklyn, N. Y.

8-16MM Films silent-sound, bought, sold, exchanged. Films rented everywhere. Free catalogue (with sample art 10c). Garden Film, 317 West 50th, New York.

HOLLYWOOD'S most glamourous beauties in exciting color films! Send dime for thrilling list, sample film. Cinetest, 1522 N. Mariposa, Hollywood, Calif.

NATIONALLY advertised movie cameras, projectors, films. Cash or terms. Free catalogues. Don Elder's, S-739 Boylston Street, Boston, Mass.

LEARN Motion Picture projection, management. Free Catalog. Give age. Theatre Institute, 375 Washington, Elmira, N. Y.

ARTIST'S live model studies. Exclusive slides and movies by West Illustrations, 1157 1/2 N. McCadden, Hollywood, Calif.

PASSION Play Complete 8MM. \$15.00. Arteract, Hammond Bldg., Hammond, Indiana.

"DIFFERENT" home movies. Sample, catalog, dime. Bantam, Room 903, Michigan-Ohio Building, Chicago.

8-16MM Art films. Free catalogue (sample 10c). Parkway Exchange, 961 Eastern Parkway, Brooklyn, New York.

VITACHROME films, 100' 16mm \$1.98, 25' double 8mm, 98c. Processing included. Vitatone, 582 Bushwick Ave., Brooklyn, N. Y.

NEW Film exchange plan and catalog of movie equipment. Paramount Mfg. Company, Dept. M-18, Box 224, Back Bay, Boston, Mass.

DEVELOP your own movies. Complete, illustrated instructions, 15c. Corona Laboratories, 1028 New York Ave., Brooklyn, N. Y.

AMAZING Hollywood Productions. Sample Scene, Lists, Dime. Erwine's Laboratories, Allentown, Pa.

16MM SUBJECTS, 100 ft., \$1.50. 35MM Cameras, Projectors, cheap. Avond, 747-8th Ave., New York.

CAMERAS, Projectors, Films, Lists, free. (Sample film, 10c.) Box 337, Valley Stream, N. Y.

#### MOTORCYCLES, BICYCLES & SUPPLIES

MOTORCYCLE, parts, accessories. Most complete stock. New & used. We specialize on Mail orders. What do you need? 35 page catalog 10c. Whitman Motorcycle & Supply Co., 405-9 Southwest Blvd., Kansas City, Mo.

ALLOY Pistons—\$3.50. Harley, Indian, Henderson, Cleveland. Cylinders reground, scores welded, new and used parts for less. Catalogue and wings pin 10c. Ballak, 811 N. 9th, St. Louis, Mo.

MOTORCYCLES, reconditioned. New, used, parts and accessories. All makes. Large stock. Bargains. Illustrated catalog, 15c. Indian Motorcycle Sales, Kansas City, Mo.

#### MUSIC, MUSICAL INSTRUMENTS

MUSIC composed to words. Rhyming pamphlet on request. Phonograph recording of completed song. Send poem. Keenan's Studios, Dept. PS, Box 2140, Bridgeport, Conn.

IT'S easy to play—Popular Piano in full Chords and Swing Bass. Free information. Moreau Studio, Conrad Building, Providence, Rhode Island.

SWISS Musical Movements, any type tune. \$2.00, \$2.60, \$2.95 & up. \$1.00 deposit. Grace, Box 57, Baldwin, N. Y.

WANTED! Lyrics, melodies for songs. We arrange, publish, sell. Superior Song Studios, Passaic, N. J.

PHONOGRAPH Records 10c. Catalogue. Paramount, MT-358 East Market, Wilkes-Barre, Penna.

ORCHESTRATIONS. Popular Backnumbers 7-\$1.00. Sheetmusic 15-\$1.00. Terminal, 3313 Lawrence, Chicago.

PIANO—Easy ear, note course \$1.00. Magic Key, 111A West Broadway, Glendale, Calif.

PIANO—By ear. No notes. Beginners. Complete method. \$1.00 prepaid. Arthur Studios, Sheepshead, Box 41, Brooklyn, N. Y.

LEARN Swing piano! Postal brings free folder. Christensen, 465 Kimball Hall, Chicago.

SONG Poems wanted. Free examination. McNeil, Master of Music, 510-PS South Alexandria, Los Angeles, Calif.

PIANO By ear. Free booklet. Write Day-V-Way, Dept. 8-B, Dearborn, Mich.

#### OLD GOLD, WATCHES, PRECIOUS STONES

GOLD \$35 ounce. Mail old gold teeth, crowns, jewelry, watches—receive cash by return mail. Satisfaction guaranteed. Free information. Dr. Weisberg's Gold Refining Co., 1500-B Hennepin, Minneapolis, Minn.

ELGIN, Waltham Watches \$3.50. Make big money. Free watch and jewelry catalog. Plymouth Jewelry Co., 163-B Canal St., N. Y.

WANTED! Gold, silver, platinum, diamonds, mercury, etc. Ship! Simon's Jewelry, 353 Old Arcade, Cleveland, Ohio.

#### PATENT ATTORNEYS

INVENTORS: Take first step toward protecting your invention—without obligation. Write for Free "Record of Invention" form for establishing date of invention and Free "Patent Guide for the Inventor"—telling importance of prompt action, confidential search service; how to sell and market inventions; details of convenient payment plan. Send today for free "Patent Guide" and "Record of Invention" form. Clarence A. O'Brien, Registered Patent Attorney, 1M2B Adams Building, Washington, D. C.

INVENTORS: Before disclosing your invention to anyone send for Form "Evidence of Conception"; "Schedule of Government and Attorneys' Fees" and instructions. Sent free. Lancaster, Allwine & Rommel, 413 Bowen Building, Washington, D. C.

INVENTORS: Send for free copy my 72-page book on patents. Reasonable terms. Prompt action. Confidential, personal service. L. F. Randolph, Dept. 340-A, Washington, D. C.

PATENTS—Trade marks. Preliminary advice, book and disclosure form free. Personal service. Irving L. McCathran, 316 McLachlen Bank Bldg., Washington, D.C., Registered Patent Attorney.

PATENTS—Booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 724 Ninth St., Washington, D. C.

"INVENTOR'S Guide" free; full information about patenting, selling inventions. Frank B. Ledermann, 154 Nassau St., New York.

"PATENT-Particulars" and Blanks, free, airmailed. Sterling Buck, P-Hotel Plaza, Washington, D. C.

#### PATENTS

WE Successfully sell inventions, patented and unpatented. Write us, if you have a practical, useful idea for sale. Chartered Institute of American Inventors, Dept. 3-B, Washington, D. C.

#### PERSONAL

IMPROVE your character, employment, popularity. Understand the lines on your hand. Distinguished hand analyst tells you how. \$1.00 brings complete Formula, Charts, Instructions. Box 507, Studio City, Calif.

FOOT sufferers—Arch Supports, made from your feet impression. Amazing Relief \$1.50 pair. Guaranteed. Send for Impression material. Nu-Feet Co., 1472 Broadway, N. Y.

WIN prize money: Booklet, "Successful Contesting", shows how—10c, postpaid. Bulletin listing \$100,000.00 prizes included. World Publishers, 4515-L, Cottage Grove, Chicago.

RADIANT Health. We guarantee to improve your health—Kretschmer's Toasted Wheat Germ will do it. Prepaid \$1.45, Three weeks supply. Kretschmer Corp., Dept. PS, Saginaw, Mich.

COUGHING—Chestcolds—Bronchitis? Quick pleasant Relief. Make your own Remedy. Famous drugless Recipe, easily prepared. Big Savings! Free particulars. Trable, 866 Irving Park, Chicago.

ASTHMA—Wonderful relief from choking, gasping asthma paroxysms. Regular \$1.00 bottle sent on trial. If it helps you, pay \$1.00. If it doesn't, pay nothing. Meldol, P.O. Box 1061, Detroit, Michigan.

SAVINGS Up to 50% on nationally advertised merchandise, radios, broilers, toasters, electric shavers, clocks, etc. Free catalogue. Quentin Purchasing, 131 W. 42nd St., New York City.

CONSTIPATION can be corrected by natural methods. My experience may help you. Send 25c. Joseph Beregsasi, 1825 Putnam Ave., Brooklyn, N. Y.

MAKE money contesting! Monthly contest publication demonstrates—15c. "Contestants", 1182-A Broadway, New York.

SCHICK Electric Shavers, \$5.50. Newly reconditioned. Guaranteed one year. Exclusive Shaver Shop, 1526 Franklin Street, Oakland, Calif.

SINUS Trouble. If a victim of Sinus or Catarrhal Infection write National Laboratories, Benj. Franklin Station, Washington, D. C.

GIRLS! Win Happiness! Quarter dollar for Information. J. J. Vogt, Monclova, Ohio.

MAKE Money! Start a letter club. Easy, fascinating. Information 10c. Box 3, San Diego, California.

LOWEST prices blades, Apris, X-cellos, Silvertex, Texide; many others. Free details. Star Products, Buffalo, N. Y.

SELL men's needs! 200% profit! Free catalogue! American Trading, B667 West 161st, New York.

NERVOUS? Conquer fear, worry, bashfulness! Free, special information. John Englund, Box 335A, Ironwood, Mich.

"STOP That Cough". Use Homo, \$1.00 and 60c sizes. Address "Homo", 580 South Park, Buffalo, N. Y.

150 DESCRIPTIONS, names, addresses, 25c. Thirty, 10c. Hywest, Southhaven, Minnesota.

OLD Dental Plates remade with transparent life-like plastic. Free booklet. Beati-Pink Co., Dept. 32, Union City, N.J.

JOIN U. S. Rocket Society! Information, dime. 4108-501 N. Kenmore, Chicago.

STODDARD'S Steel Square Pocket Book, \$1.00. Route 4, Indianapolis, Ind.

#### PHOTO FINISHING

IMMEDIATE Service! Pictures returned same day order is received. Sixteen guaranteed Deckled-edge Velox prints from roll, 25c. One colored or two plain enlargements plus 8 Deckled-edge Velox prints, 25c. Special! Coupon for 8x10 enlargement given with each 25c order. Any 36 exposure 35mm film fine-grain developed, "Magic-Eye"—timed. Vaporate Treated and each good negative enlarged to 3x4 on Deckled-edge Velox paper, only \$1.00. Reloads: 36 exposure, 50c; 18 exposure, 35c. 3x4 Deckled-edge reprints, 3c each! Details, sample, mailers, other bargains free on request. American Studios, Box 71, LaCrosse, Wis.

35mm, ARGUS, Leica, etc., (except "Mercury") 36 exposure rolls, fine grain developed (Eastman DK-20) and beautifully enlarged to 3" x 4" glossy prints, 90c. Cartridge reloaded with Eastman Plus X, 35c. 18 exposure rolls, 55c, reload 20c. Films permanently protected by revolutionary Cryolyte Process. 24-hour service. Satisfaction guaranteed. Free mailing bags, sample print. Write Technifinish Laboratory, 641-645 Brown St., Dept. 712 Rochester, N. Y.

DOUBLESIZE Prints. Your roll developed and 8 doublesize prints 25c; from 116, 120, or 127 size negatives you receive 4x6 inch prints. All smaller sizes receive 3 1/4 x 4 1/2 inch prints. 16 exposure rolls 50c; 12 exposure rolls 35c. Reprints 3c each. "Our Guarantee". Everlasting Hi-gloss Finish. Overnight service. Pacific Photo Service, Box 666, San Francisco, Calif.

FOR the discriminating amateur—8 exposure rolls, 2 prints each 25c. Miniature rolls enlarged 3 to 8 times, 8 exposures 25c, 16 exposures 50c, 35MM 36 exposures, 3x4 enlargements \$1.00. Unexcelled quality, prompt service. Paramount Photo, 327 E. 92nd St., New York.

FINER Finishing Specials, 25c. 6-8 exposure rolls developed, your choice 2 prints of each or 1 enlarged print of each negative on Genuine Nationally known Moen-tone Enamel. Superior quality. Moen Photo Service, 200 Moen Bldg., La Crosse, Wis.

OIL coloring photographs a fascinating hobby or profitable business. Learn at home. Easy simplified method. Previous experience unnecessary. Send for free information and requirements. National Art School, 1315 Michigan, Dept. 1727, Chicago.

SAMPLE Free! Your Favorite Snapshot will make a beautiful personal Christmas Card. Send us the negative, with 5c for handling, and we will show you. No obligation. Finerfotos, Box X-3, Minneapolis, Minn.

ROLL developed and printed 10c, when purchasing a new roll from us. All low prices. Roll printed all double size 25c. Write for specials and free mailers. Film Foto, Box 357, Passaic, N. J.

FREE Trial—16 sparkling Lifetime prints, three lovely Hollywood enlargements and Free Leather frame with roll—25c. 20 reprints 25c; 100—\$1.00. Overnight service. Lifetone Studios, L-27, Des Moines, Iowa.

PHOTOSTAMPS, perfect copies of your favorite photograph (returned unharmed) stamp size, gummed, perforated, 25 for 50c. Ideal Photo Studio, Box 266AB, Paul's Valley, Oklahoma.

BEAUTIFUL Christmas cards with envelopes, from your negative, 60c dozen, trial 4 for 25c. Rolls developed two prints each exposure, 25c. Jones Studios, Davenport, Iowa. "Where the West Begins".

ROLLS developed and 4x6 oversize glossy Velox prints 8 exposure 25c. 12 exposure 35c. 16 exposure 50c. Overnight service. Clemet Photo Service, 1318 W. Columbia Ave., Philadelphia, Pa.

ROLL developed and 8 beautiful enlargements 2 to 6 times larger—deckled edge—high gloss. Any 8 exposure roll 25c coin. Reprint enlargements 3c each. Alden Photos, 258-C Astor Station, Boston, Mass.

ROLLS developed, two prints each and two free enlargement coupons, 25c; reprints. 2c each; 100 or more, 1c. Summers' Studio, Unionville, Mo.

ROLL Developed, 8 brilliant fadeproof Velox prints and two professional enlargements 25c. Overnight service. Young Photo Service, 406-C Albany, N. Y.

ROLL developed, eight beautiful professional 4x6 gloss enlargements; 25c, Crystal Studios, Box S-159, Rushford, Minn.

**IDEAL** Photos beautifully finished wide border deckle edge, 25c. roll of 8 and free enlargement. Ideal Photos, Box 2255, Paterson, N. J.

**FINERFOTOS** guaranteed. Many economy offers. Roll developed and 16 prints, 25c. Request offer No. 2. Finerfotos, Box 898-18, Minneapolis, Minn.

**TWO** beautiful prints from each picture on roll 25c. Twenty years of satisfied customers. QuicK Service. Lens Photos, Dept. J-9, Janesville, Wis.

**PROMPT** Service! Roll developed, two prints each negative 25c. Hench Studios, Harrisburg, Pa.

**3 BEAUTIFUL** 5x7 enlargements from your negative, 39c. Photoart, Strasburg, Ohio.

**ROLL** Developed—16 guaranteed prints, two coupons on enlargements, 25c. Smart Photo, Winona, Minn.

**16 OVERTSIZE** Deckled prints and two enlargements, 25c. Owlphoto PS2, Weatherford, Okla.

**20 REPRINTS** 25c, 100—\$1.00. Roll developed 16 prints 25c. 5x7 enlargements 10c. 3—25c. Nordskog, 58, Maywood, Ill.

#### POULTRY & SUPPLIES

**TURKEY** World—Illustrated monthly magazine devoted entirely to commercial turkey growing. Tells how others make big profits. One year \$1.00, five months trial. 50c. Turkey World, Desk 276, Mount Morris, Ill.

**AMERICA'S** Leading Poultry Magazine tells how raise poultry for profit. Leading discoveries; practical, money-making ideas. Subscribe now. Five years \$1.00, one year 25c. Poultry Tribune, Dept. C-56, Mount Morris, Ill.

1942 **SHOULD** be Poultry Raisers Banner Year. Help Defense—Profit yourself—raise poultry the "American Way." Read American Poultry Journal, 564 S. Clark, Chicago. 5 years \$1.00, 6 months 10c.

**POULTRY** Profits, Nature's Way! New method, Booklet, stamp. Natural Incubator System, Phoenixville, Pa.

#### PRINTING, MULTIGRAPHING, MIMEOGRAPHING, LABELS

**1000 ENVELOPES**, letterheads, billheads, statements, embossed business cards, \$1.75 each. Quality Service Guaranteed. Standard Printing Co., Fairmont, W. Va.

**PICTURE Labels**—700 Designs 10c. Refundable. Arrowprint, PS1241, Waterbury, Conn.

**100 BOND** 8½ x 11 Letterheads and 100 Envelopes, \$1.00. Benneville, 907 West Roosevelt, Philadelphia.

**DISTINCTIVE** Printing that you'll take pride in using. Samples Free! High-Spire Press, R-1, High Spire, Pa.

**MODERN** color printing, different samples. Keego Printing, Keego Harbor, Michigan.

**HAMMERMILL** Letterheads, envelopes, all colors, 32 styles type. Free particulars. Woodruff's, 217-D Lewis, Duluth, Minn.

**JOB** Printing. Quick, reasonable. Samples. Atlantic, Box 653-B, Rock Hill, S. C.

#### PRINTING OUTFITS & SUPPLIES

**OWN A** Printing Business. Good profit in spare time. Print your own cards, stationery, circulars, advertising. Junior outfit \$8.25, Senior \$16.55. Simple rules. Details free. Kelsey, Inc., P-8, Meriden, Conn.

**PRINT** at home. 10c will bring a complete catalog of presses, type and supplies. P. Peiffer & Company, 4 Columbia St., Newark, N. J.

**PRESSES** bought, sold. What have you? List 3c. Meigs, 190B Cook, Meriden, Conn.

**PRESSES**, Bargain Supply Catalog. Send stamp. Bradshaw, 3214-W Huron, Chicago.

**PRINTING** Presses, Type, Supplies. Lists 3c. Turnbaugh Service, Loysville, Pa.

**NEW** Type 29c font. Catalog dime. Box 123Y, Jackson, Michigan.

**INEXPENSIVE** 6x9 Printing Press. Details Free. Novelty Shop, Downsville, La.

**RADIO** engineering, broadcasting, aviation and police radio, servicing, marine and Morse telegraphy taught thoroughly. All expenses low. Catalog free. Dodge Institute, Poplar St., Valparaiso, Ind.

**RESISTOR** and condenser kit worth \$5.00 retail and money saving catalog for only \$1.00, add dime postage. Radio Warehouse, 362-C Wooster, Akron, Ohio.

**REVISED** plans 18 Crystal Sets (SW record 4800 miles), with "Radiobuilder" year, 25c. Laboratories, 1406-T 77th Avenue, Oakland, Calif.

**GET** Discounts on Zenith, RCA-Victor, Philco, Crosley 1942 Radios. Save Plenty. All Models. Write or wire: Gravlee's, Kennedy, Alabama.

#### RARE COINS

**COMMEMORATIVE** 1½c—10 Different Uncirculated, \$10.00. Indian Head Cents—30 Different Dates, \$1.00; Wanted: Rare U. S., Foreign Gold, other rare coins. Highest prices paid; premium list 8c. Bebee Stamp & Coin Co., 1180 E. 63rd Street, Chicago, Ill.

**FREE!** Foreign Coin, banknote and large 50 page illustrated coin catalogue to approval service applicants. Send 3c postage. Up to \$20 cash paid for Indian head cents. All dates wanted. Buying list 10c. Tatham Coinco, Springfield-D50, Mass.

**WILL** Pay \$15.00 Each for certain Lincoln Pennies! Indianheads \$100.00; Dimes \$1,000.00. Illustrated catalogue 10c. Federal Coin Exchange, (PS), Columbus, Ohio.

**PRICE** List of U. S. Coins, Bills and Accessories, 10c. 75 Illustrations. 2500 Quotations. James Randall, 341 S. Dearborn, Chicago.

**COMMEMORATIVE** 1½c. Columbian, Lincoln, Stone-Mountain, Long-Island, Cleveland, \$1.00 each. Illustrated catalogue 25c. Norm Shultz, Salt Lake, Utah.

**RARE** Coin Encyclopedia! Revised edition. \$1.00 postpaid. Stevenson, 2102 Lothrop, Omaha, Nebr.

**WE** purchase all Indianhead pennies. Purchasing catalogue 10c. Greenwood, 398 Broadway, New York.

**16 NICE** Coins, 25c. Bishoff, 414 E. 8th, Kansas City, Mo.

#### RUBBER STAMPS

**CUSHIONED**, 2 lines 25c. 3—35c. Ours are better! Ad-Crafts, LaCrosse, Wis.

**3 LINES** 27c; Indexed 35c; Signatures \$1.50. Prinrite, Wauwatosa, Wis.

**NONE** Better, 3 Lines 35c. Federich Company, B412-L, East Pittsburgh, Pa.

#### SONGWRITERS

**WANTED**. Poems, to be set to music. Submit for consideration. Transcription records made. Rhyming Pamphlet Free. Keenan's Studio, PS, Box 2140, Bridgeport, Conn.

**SONGWRITERS**: poems wanted for musical setting. Recordings, Radio, Publication Advice. Send poem. Five Star Music Masters, 646 Beacon Bldg., Boston.

Music Composed, song printed, recorded. Reginald Belcher, Chatham, New Jersey. Established 1910.

**SONG** Poems wanted. Free examination. McNeil, Master of Music, 510-PS South Alexandria, Los Angeles, Calif.

**SONGWRITERS**. Write for free booklet, profit sharing plan. Allied Music Company, 7808 Reading, Cincinnati, Ohio.

**SONGWRITERS**—Write for Free Book—Send Song Poems. Variety, Salem, Indiana.

**SONGWRITERS**: Send poem for our plan and Free Rhyming Dictionary. Richard Brothers, 146 Woods Bldg., Chicago.

**SONGWRITERS**: Words, melodies. Amazing offer. Hibbler, C-15, 2157 No. Avers, Chicago.

#### SPORTING GOODS, GUNS, FISHING TACKLE, ARCHERY

**USE** the Schafer Golf Putt-In for practical indoor practise putting in gymnasium, club, parlor or recreation room. Circular sent on request. E. F. Schafer, 27361 Eldorado, Lathrup-Townsite, Birmingham, Michigan.

**BOWS**; Arrows; Equipment; Raw Materials; Gadgets: For Target, Flight or Field Archery. World of information in our free catalog that's different. Hatfield's, 1762-B North Vermont, Hollywood, Calif.

**HUNTING**, trapping, camping equipment. Used guns. Catalog. Howe, Coopers Mills, Maine.

**PROFESSIONAL** Gunstock Checkering Tool, with instructions, 25c. Dueffey, Covington, Ky.

**ARCHERY** equipment: catalogue free. Mid-West Archery, 2209-D East 75th, Chicago.

#### STAMP COLLECTING

#### NOTICE

Readers answering ads offering *Approvals* receive a selection of stamps from which they may make purchases at prices indicated. Ten days are allowed for payment and return of undesired stamps. Otherwise approval applicants become subject to Section 2350, Postal Laws & Regulations, 1932, providing penalties for obtaining property by false pretense.

**FIVE** big items for 5c: (1) Scarce Mexico picturing world's oldest stamp; (2) "Mystery stamp" from strange country—cat. price 50c; (3) Fine packet from "conquered countries" which may never again issue stamps—Danzig, Czechoslovakia, Poland, etc.; (4) U. S. \$2, \$4 & \$5 high values; (5) Collection 45 dif. Asia and South Sea Islands (cat. price about \$1.00!) incl. Burma, Dutch Indies, Selangor, etc. Everything above for only 5c to approval applicants! Jamestown Stamp Co., 227 Wellman Bldg., Dept. 5, Jamestown, N. Y.

**GIANT** Packet 138 All Different from Africa, South America, South Sea Islands, etc. Includes Nicaragua airmail, two scarce unused United States cataloging 20c, triangle and animal stamps; many others. Also includes fine collection 25 different British Colonies—Charkari, Jamaica, Johore, etc. and United States \$4 and \$5 high values. Total catalog price over \$4.00! Everything for only 5c to approval applicants! Mystic Stamp Co., Dept. 55-A, Camden, New York.

**SUPER-WONDER** Packet offered containing stamps from Afghanistan (oblong), Transjordan (emir), North Borneo (buffalo), Manchukuo (Mausoleum), Sudan (native), Sarawak (raja), Guadeloupe (sugar refining), Costa Rica (triangle), Iraq (late king), Brunel (boating); this entire packet for only 5c to approval applicants. Big illustrated lists free. Kent Stamp Co., G.P.O. Box 87 (24), Brooklyn, N. Y.

**FREE!** Unmatchable World Collection containing desirable British Colonial Commemorative issue complete. Valuable South American set exploiting colorful natural resources. Bi-colored pictorial issue from mysterious Indian Ocean Island. Rampant Lion of Bohemia issue, plus 100 different stamps, many from subjugated European Countries, only 3c to approval applicants. Friendly Filatelists, Box 4428S, Philadelphia, Pa.

**POSITIVELY** Greatest Free offer—Latest Scott's International \$4.00 Stamp Album—covering entire World, contains 36,000 illustrated, descriptive spaces; Scott's 1942 Standard \$3.50 Catalogue "Philately's Encyclopedia"—absolutely Free to applicants for Foreign Approvals becoming customers. Bargain Stamp Service, Santa Ana, California.

**500 UNITED** States for 10c! 500 U.S.A.—absolutely unpicked and unsorted—just as received from church Missions. Many varieties, including commemoratives, airmails, high values up to \$5.00 denomination! Price only 10c to approval applicants! Money back if not delighted. Swan Stamp Co., Dept. 69A, Dunkirk, N. Y.

**UNITED** States approvals complete coverage fine quality, attractive prices. Seminole Stamps, Box 536, Coconut Grove, Florida.

**SURINAME**; Transvaal; Venezuela; Newfoundland; Tanganyika; Tasmania; Wurtemberg; Herzegovina; Travancore; Dutch Indies; Siberia; Mongolia; Barbados; Rhodesia; Queensland. Everything 5c. Imperial, 30-P Inwood Station, New York City.

**WORLD'S** Smallest Airmail—Diamond and Triangle Stamps, Free Stamp Magazine, also magnifier to study your stamps, with large collection of stamps from scarce countries. A Bargain, 5c with approvals. Capital Stamp, Dept. 10, Little Rock, Arkansas.

**A COLORFUL** Collection of stamps from countries of the Western Hemisphere, including scarce Airmails, beautiful Commemoratives, Charities, interesting pictorials, sets etc. Only 5c to approval applicants. Badger Stamp Co., 228-S West Wisconsin, Milwaukee, Wis.

**JAPAN** national Park souvenir sheets. Those prices raised about 35%, but we serve at former price (catalog 1941). Japan 100 dif., \$1.00; China 150 dif., \$1.25. G. T. Yano, 193 Jackson Street, San Jose, Calif.

**TENTH Anniversary Special!** 100 all different British colonies only, exceptional quality and value, 10c with fine approvals and illustrated lists! One to a customer. Midwood Stamp Company, Midwood Station, Brooklyn, New York.

**12 DIFFERENT** Famous Americans, plus 12 different Presidents plus U.S. Illustrated Price and Check List, only 5c to U. S. approval applicants. Metropolitan Stampco., 198-X Broadway, N.Y.C.

\$1.00 (Cat. Price) for 1c! Two mint U.S.A., cat. 20c; "queer countries" packet (Djibouti, Manchuria, etc.); scarce set Russia, cat. 75c. Everything for only one cent to approval applicants! Garcelon Stamp Company, Box 418, Calais, Maine.

**A DILLER!** A Thriller! Strange countries galore! Borneo, Thailand, Pahang, Johore, etc., etc., plus Manchukuo Census Set, just 10c with approvals. Odd Stamps Co., 5391 Metropolitan Station, Los Angeles, Calif.

**FINE** Approvals, freshly mounted. Fast, personal service. Tell me what countries you prefer and I'll send their stamps. Milton Skinner, 306 East Fourth, Long Beach, Calif.

**SEYCHELLES**, Nejd, Caymans, Manchukuo, Brunei, Turks Caicos, British Solomons (Cannibal Land). Everything 3c with approvals. Viking, 130-P Clinton St., Brooklyn, N.Y.

**FREE**—World's only Octagonal (eight-sided) stamp and 25 different Japanese pictorials to approval applicants. Charles Cleaveland, 806 N. Humphrey, Oak Park, Ill.

**GIGANTIC Value:** 80 all different U. S.—old & new issues 25c. Bargains in other countries. Armour Stampco., St. Albans, N.Y.

**CHARITIES**—The hard to get stamps, 25 different, including sets; 5c with approvals. Lyman, (formerly Reliable Company) 97 Nassau Street, New York.

**FREE!** Scarce Yugoslavia B23-5, complete set; to approval applicants sending 3c postage. Stamp Collectors Service, Box 325, Church Street Annex, New York.

**SPECIAL**—Airmails—23 different, including Zeppelin, Triangles, Latin-America, etc., 5c with approvals. Continental Stamp Co., Dept. C, Sandy Hook, Conn.

**JAPAN** Commemorative. Pictorial Mixture 1000, \$1.50 (Payment by mint stamps). N. Miyake, Box 35, Tsu City, Japan.

**1000—U.S.** mixed, containing old and recent commemoratives, high values, precancels, etc. 35c in coin. J. W. Dauber & Son, Bethesda, Md.

**206 DIFFERENT** stamps including Kedah, Haiti, Cochin, Albania, Johore, Perak, only 10c to approval applicants. Reich Stamp Co., 4647 Kenmore, Chicago, Dept. S3.

**ICELAND**: Cape Good Hope; also 50 other countries. This exceptional collection only 5c with approvals. Stamp Service, 53-C Webster Avenue, Brooklyn, N.Y.

**25 DIFFERENT** New George VI issues from British Colonies in all parts of the World, 5c with approvals. Bookman, Box 145-S, Maplewood, N.J.

**WHOLESALE** Supplements to dealers for 10c postage. Hundreds of bargains. Grossman Stamp Co., 102 W. 42nd, New York.

**UNITED States**. Hard to get, yet inexpensive U. S. stamps in our approval books. 1500 varieties in stock. Southern Stamp Co., Box 70, Miami, Fla.

**STAMP Dealers**—Your ad in this column will produce profitable business at low cost. Write for proof. O. K. Kelly, Dept. S-1, 353 Fourth Ave., New York, N.Y.

**BIG Packet** 150 United States and foreign, only 5c to those requesting fine approvals and lists. Wineholt, Woodbine, Pa.

**33 DIFFERENT** United States—3c. Approvals. Utechts, 1143X North Keeler, Chicago.

**3c BRINGS** ten different stamp exchange plans. Hofmann, 1715 First Avenue, New York.

**PHILATOPIC** Monthly free—forty pages. Includes Stamp Encyclopedia. Free. Write Empire Stamp, Dept. PR, Toronto, Canada.

**DESTROYED** Zeppelin complete 3 cents. Approvals. French, 60 Arcade, Cleveland.

**FREE!** Beginner's packet. Postage 3c. Writsel, PS-267 South Sandusky, Columbus, Ohio.

**FREE!** 50 different—3c postage. Packet Price List. B. F. Joyner, 669 University, Memphis, Tenn.

**FREE Anniversary Price List.** Bargains galore! W. T. Torgeson, West Englewood, N.J.

**300 DIFFERENT** 25c; 600 50c; 1000 \$1.25; 2000 \$3.50. Fred Onken, 630 - 79th St., Brooklyn.

**30,000 DIFFERENT** on approval at 1c, 2c, 3c Pictorials—Airmails. Palm Stamp Co., Seybold Bldg., Miami, Fla.

**77 AIRMAILS**, Pictorials, Commemoratives, Triangle, etc., 5c. Approvals included. Lufbery, Middletown, Conn.

**1000 MIXED** United States, 18c. Two pounds, \$1.00. Wholesale Mixture list Free. Halay, 452 W. 58th, New York.

**50 CANAL** Zone, Philippine, U. S. Approvals, 10c. Stamp Shop, 813 Holland Bldg., St. Louis, Mo.

**FINE** packet 75 different British Colonials, only 10c to approval applicants. "Crescent Stamps", London, Canada.

**FREE** Stamps with penny approvals. Pictorials, Commemoratives. Raymax, 1133-X Broadway, N.Y.C.

**50 DIFFERENT** Brazil, 10c with approvals. Pinehurst Stamps, 90 Pinehurst Ave., New York.

**U. S. Mint** 3c, Commemorates 1935-40, 7 blocks \$1.00. Law, 6 Endicott Ave., Marblehead, Mass.

**200 DIFFERENT** Foreign; commemoratives, airmails, 10c. Approvals. Kostello, Benwood, W. Va.

**WILL** Rogers, Nicaragua Airpost stamps complete, 10c. V. O. Park, Clarksville, (S3) Tennessee.

**FREE!** Azerbaijan, Multicolored, Pictorial set. Request approvals. Koch, Boaz, Wisconsin.

**PHILIPPINES**, 17 different including Pictorials, 10 cents with approvals. Swedell, 3038 Harriet, Minneapolis, Minn.

**FIFTY** Canadian, Newfoundland, including Earlies, Commemoratives, 10c Approvals. Reed, 696 Gerrard, Toronto.

**FREE!** Complete "United States" stamp catalog with 1,000 illustrations. Harris & Co., 99 Transit Building, Boston.

**FREE**—Five beautiful Airmails, including Triangle, to approval applicants. Green and Co., Norwood, Ohio.

**500 FOREIGN** with valuable prize packet 15c. Approvals. DeMers, Box 1033, Milwaukee, Wis.

**UNPICKED!** 100 U. S. revenues on documents—10c! (700—50c.) Vanvoorde, Hyndman, Pa.

**PATRIOTIC** Collection: 125 different United States stamps for only 25c. Catalogs Free. Mission Mart, Brookland, D. C.

**FREE!** Western Hemisphere Packet. Postage 3c. Owens, 801 Welshbldg., Baycity, Mich.

**50 DIFFERENT** U. S. 5c. Approvals. Franklin, Box No. 65, Richmond, Indiana.

**EXCHANGE** your duplicate stamps. List, swappers, dime. Registrar, Box 2166, Denver, Colorado.

**SPECIAL**—50 Different U. S. Commemoratives 10c to approval applicants. Budic, 6929 West Greenfield, West Allis, Wis.

**FREE!** Pony Express set (facsimiles). Postage 3c. Roberts, 401 Shearerbldg., Baycity, Mich.

**SIX** Liberia Airmail Triangles, complete set, 7c with approvals. Lorain Brown, Marion, Michigan.

**FREE!** Canada Royal Visit complete with approvals. Chester, Box 545-V, Utica, N.Y.

**FREE Sets** "Famous Approvals" 1c "Grab-Bag". Palmer, 304 Hardy, Norfolk, Va.

**17 SHIPS!** 4 Maps! 4 Trains! 3c with approvals. Gordon, Box 201, Clifton, N.J.

**10,000 VARIETIES** 1c each! Gordon Davidson, Box 568D, Manchester, N.H.

**PENNY** Approvals that satisfy. Neil Gronberg, Box 5441S, Philadelphia, Penn.

**TEN** different United States, 40 years old, 5c. Elzea, Bowling Green, Ohio.

**FREE!** Austria War set. Postage 3c. Williams, 601 Archerbldg., Baycity, Mich.

**5000 \$1**; Packets 10c; Approvals: Griest, 409 Oak, Davenport, Iowa.

**87 1/2% DISCOUNT**. Selection against references—adults. Dolin, 31-Q Park Row, New York.

**101 DIFFERENT** Foreign, 5c Approvals. Hannay, 310 Quail, Albany, N.Y.

**20 MEXICO** 3c with approvals, 1/4c up. Josip Babcock, St. Joseph, Michigan.

**NEWFOUNDLAND**, 15 different only 5c. Altone, 2068 Daly, Bronx, N.Y.

**FREE** packet and Xmas literature. Box 6618, Northeast, Kansas City, Mo.

**BEST** One cent approvals in America. Elvin Stanton, Niantic, Conn.

**1/2 APPROVALS**; stamps at 1/2c. Mountblow, Box 11P, Rosebank, N.Y.

**SOUTH American**—100 different 10c—with approvals. Davis, Silver Lake, Ind.

## TATTOOING SUPPLIES

**START** profitable tattooing and removing business. Free instructions. Write Tatoooco, 651 S. State, Chicago.

**TATTOOING** Outfits, Supplies. Illustrated List Free. Percy Waters, Anniston, Ala.

## TAXIDERMY

**GLASS** Eyes For Taxidermy—for birds, animals, fish, decoys. Genuine Enamelled Eyes. Made in our new factory. Elwood Supply Co., Dept. 234, Omaha, Nebr.

## TOBACCO, PIPES

**MR. Pipe Smoker!** Are you satisfied with your present pipe and tobacco? I have devoted a lifetime to blending pipe tobaccos and have a large stock of finest pipes available. Thousands of contented pipe smokers throughout the country are my loyal clients. Send for free descriptive literature describing some of my most popular blends, best selling pipes and special prescription department. Introductory offer: either improved steel triple companion (tamper, pick, scoop) or reamer, guaranteed rustproof, regularly sell for 25c plus two dozen finest pipe cleaners price 10c, both for 10c. John's Pipe Shop, 1133-P Broadway, New York City.

**FREE!** Pipe Catalog! Saves you money. 396 different pipes, 70 high-grade tobaccos at bargain prices! Tells "How To Keep Pipes Sweet", etc. We ship postpaid all over U.S. Send for free catalog. No obligation. Wally Frank, Ltd., Dept. 91, 10 E. 45th St., New York, N.Y.

## TRAPPERS

**BUY** equipment where professional hunters, trappers buy. Lowest prices—biggest bargains. Write for Free Catalog. Hill Bros. Fur Dept. 346, St. Louis, Mo.

**TRAP** Fox or Coyote: Bare ground and deep snow trapping. Free circular. Q. Bunch, Welch, Minn. Box T.

## TREASURE FINDERS

**MT-SCOPE** Metal Locator fully guaranteed and unsurpassed in efficiency. Time payment plan, trade-in and accessories. Free literature. Fisher Research Laboratory, Palo Alto, Calif.

## WANTED—MISCELLANEOUS

**WANTED:** Light chemical manufacturing. We have laboratory facilities, manufacturing space, experience; also capital if your proposition looks good. Write Post Office Box 150, Holland, Michigan, giving detailed proposition.

**HIGHEST** Prices for used Cameras, Binoculars, Microscopes, Drawing Sets, Tools, any optical or scientific instrument. Satisfaction guaranteed. Gordon's, 162-S Madison, Chicago.

**MERCURY**. Cash paid promptly. Quotations free. Mercury Terminal, Norwood, Mass.

**CASH** for Old Buttons: information free. 230-E Bowman, South Bend, Indiana.

## WATCHES

**WATCHMAKERS' Materials—Tools—Watches**. Bought; Sold. Best prices for Old Gold, diamonds. Free Catalog. Ben Segal Company, Box 150, Chicago.

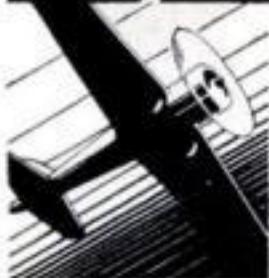
## WELDING, SOLDERING

**BARGAINS.** Demonstrator arc welders, gasoline and electric drive. Build your own portable, save \$500. Liberal Trial. Easy terms. Write Hobart Welder Exchange, Box P-1212, Troy, Ohio.

**BUILD** 60-200 Amp. A-C welder for \$16. Several plans \$1.00. Information dime. Hi-Point Electric Products, Dept. P, Beliefontaine, Ohio.

**SAVE** 50% on A.C. Arc Welders—Plans. Holgerson, Canton, Kansas.

# Big Pay in AVIATION



Earn \$50, \$75, \$100 a week in Aviation! Wonderful opportunities now. This **Lincoln Government Approved School** wants to immediately get in touch with men interested in preparing now for positions as **Professional Pilot, as Flight Instructor, as Airline Mechanic, as Airplane Factory Mechanic or Airplane Inspector**. We train you and assist Graduates in locating positions. Now offering Board and Room in exchange for after-school employment. **WRITE TODAY** for complete information.

**LINCOLN AIRPLANE & FLYING SCHOOL**  
6312 Aircraft Building, Lincoln, Nebraska

**FREE  
RADIO  
CATALOG**

## EVERYTHING IN RADIO

Your nationally known radio favorites at lowest prices. Sets, parts, supplies, etc. 1012-14 McGEE ST. BURSTEIN-APPLEBEE CO. KANSAS CITY, MO.

## SHIP MODEL SERVICE

Mr. Pratt, our Model Consultant, will advise you **FREE** of charge. A complete line of all standard kits and fittings always on hand. Also All Types **FISHER** Model Yacht Fittings JAMES BLISS & CO., INC. 220 State Street Boston, Mass.



## Wonders Through The MICROSCOPE



A new book which tells you all about **MICROSCOPY**. Turn an inexpensive microscope on hundreds of specimens within a stone's throw of your front door and you step off into a new world of wonders. Complete Manual for amateurs. How to use equipment, secure and preserve specimens, take photomicrographs, etc. Numerous illustrations. Full cloth bound \$1.00.

**POPULAR SCIENCE MONTHLY**, Dept. 121

353 Fourth Ave.

New York, N. Y.

## I WANT TO TRAIN YOU For A Big-Paying Job IN THE MEAT BUSINESS



I have trained hundreds of men like you to become expert Meat Cutters. Good pay. Steady jobs everywhere. Government figures show over 50,000 new meat markets. My school offers you quick, short, intensive training. Actual practice in big cutting rooms and retail department. Union card **FREE**. Pay after graduation. Valuable employment service. Write me today for my big **FREE** catalog and all details.

National School of Meat Cutting, Inc., Dept. O-9, Toledo, Ohio.

**YOU CAN HELP**  
SHOES, TIRES,  
RUBBER GOODS Last Longer.  
Fix them with new plastanoind "putty."  
MENDS holes and worn spots  
in leather, cloth, rubber.  
Spreads on like butter. Dries  
tough overnight. Flexible,  
non-skid, water-  
proof. Won't come  
off—guaranteed. 25  
repairs—25 cents.  
AT HARDWARE AND 10c STORES

**BROOKLYN YMCA TRADE SCHOOL**

**MAIL COUPON**

**Short Trade Courses**, including Defense trades offered. Day or evening courses qualify you for Defense Jobs.

**Full Shop Equipment**  
Unexcelled Instruction  
Fireproof Dormitories.

**Special Privileges**. **Check your interests** on coupon to receive free literature.

**Aircraft Construction**  **Welding**  
 **Machinist**  **Tool and Die Making**  
 **Mechanical Pre-Engineering**  
 **Diesel Engines**  **Oil Burner**  
 **Diesel Pre-Engineering**  
 **Mechanical Drafting**  
 **Auto Mechanic**  **Talking Pictures**  
 **Refrigeration**  
 **Television and Radio Mechanic**  
 **Architectural Drafting**  
 **Armature Winding**  **Electrical**

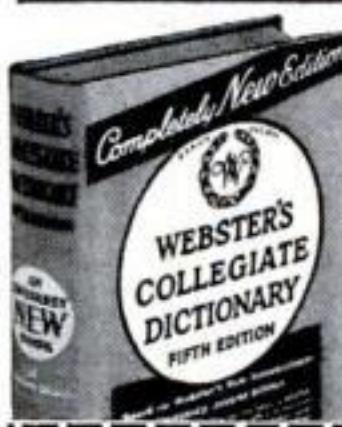
1123 Bedford Ave., Dept. P.S.  
Brooklyn, New York City, N. Y.

Name \_\_\_\_\_

Address \_\_\_\_\_

*For Christmas*

## Give the Best Handy-Sized Dictionary **WEBSTER'S COLLEGIATE**



**BEST** because it is a genuine **MERRIAM-WEBSTER**, abridged from **WEBSTER'S NEW INTERNATIONAL DICTIONARY**, Second Edition—the "Supreme Authority." 110,000 entries; 1,800 illustrations; 1,300 pages. Price \$3.50 to \$8.50, depending on binding. Look for the famous **CIRCULAR TRADE-MARK**. Purchase of your bookdealer. **Mail coupon for fascinating Quiz and Picture Game**—Free. **G. & C. MERRIAM CO.**, Springfield, Massachusetts.

**G. & C. MERRIAM CO.**, 795 Federal St., Springfield, Mass.  
Please send me **FREE** Quiz and Picture Game, also full information about Webster's Collegiate Dictionary, **Fifth Edition**.

Name \_\_\_\_\_

Address \_\_\_\_\_

## INVENTORS FREE Patent Facts

**Protect Your Idea! This Free Inventors' Kit Shows You How—**

Your ideas may be worth money! Get facts first and save time and money. Competent advice on patent procedure is essential to good results. Our 66 years' experience enables us to explain everything you need to know about protecting and commercializing your idea. Prompt, confidential service and results. **Mail coupon today for free set of booklets as shown and Special "Certification of Invention" form (covers first important patent step).**

### C. A. SNOW & CO.

Registered Patent Attorneys Since 1875

2112 SNOW BLDG., WASH., D. C.

Please send me the free books and form mentioned without cost or obligation.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_



MAIL THIS  
COUPON FOR  
FREE BOOKS

# FOR YOUR OWN ENJOYMENT

## THE MOST PRACTICAL, EASY-TO-FOLLOW MANUALS EVER PUBLISHED

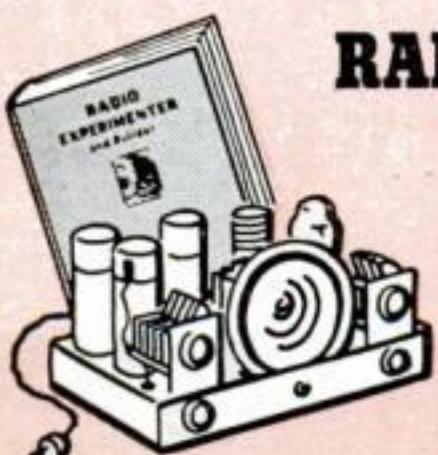
These practical, easy-to-understand handbooks will help you get the most out of your hobby. Written by experts especially for Popular Science Monthly readers, they are invaluable to the mechanically minded man. Each book is fully illustrated, with pictures and diagrams. Bound in sturdy library cloth. You need not hesitate to order them for yourself or for gifts. We guarantee complete satisfaction or money back.



### FIX IT YOURSELF

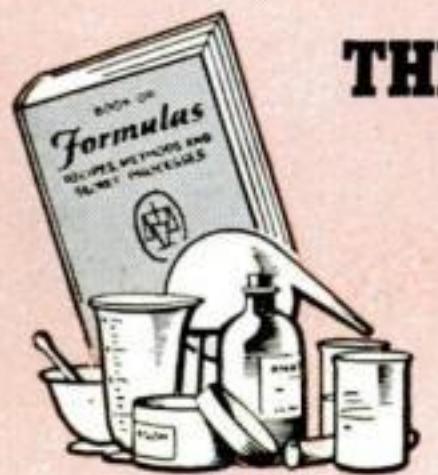
256 pages, \$1.00

Save yourself a lot of expense by doing your own odd repair jobs. This famous book shows with diagrams and directions how to fix and repair furniture, electric outlets, windows, doors, leaky pipes, floor boards, chimneys, boilers, weather proofing, painting and hundreds of other construction and repair jobs. Picture diagrams show how each job is done. 256 pages. Full cloth bound, \$1.00.



### RADIO BEGINNERS SIMPLIFIED MANUAL \$2.00

Every radio operation from trouble shooting, to building and improving marvelous long and short wave sets, is made so simple and clear that you just cannot fail to understand many things that may have puzzled you before. A few minutes a day with this manual will teach you what it takes years to learn without it. Prepared by technical radio experts who KNOW how to explain things for non-technical radio enthusiasts. Cloth bound, 256 pages, hundreds of simplified drawings and diagrams, \$2.00.



### THE BOOK OF FORMULAS

250 pages, \$1.00

The basis of many fortunes! Formulas, recipes, methods and secret processes for making and improving upon beverages, glues, cements, enamels, paints, cosmetics, dyes, inks, tooth pastes, soaps, silver and nickelplating, oils, lubricants, and a thousand and one things for commercial and household use! Your fortune may hang upon one little hint from this most amazing of books! Information from a thousand sources—not normally available to the general public—now published for the enjoyment and practical profit of our readers, cloth bound, \$1.00.



### ELECTROPLATING

260 pages, \$2.00

Written especially for the amateur, this book tells you how to utilize many odds and ends to build a complete home electroplating workshop. Instructions, pictures, and diagrams show how easily you can do copper, nickel, chromium, silver and gold plating. How you can plate household or automobile fixtures, hardware, tools, silverware, ornaments, clocks, watches, bracelets, rings, metal parts of all kinds. Scores of illustrations, diagrams, and pictures. 260 pages, cloth bound, \$2.00.

# OR FOR CHRISTMAS GIFTS

## "GUNS and GUNNING"

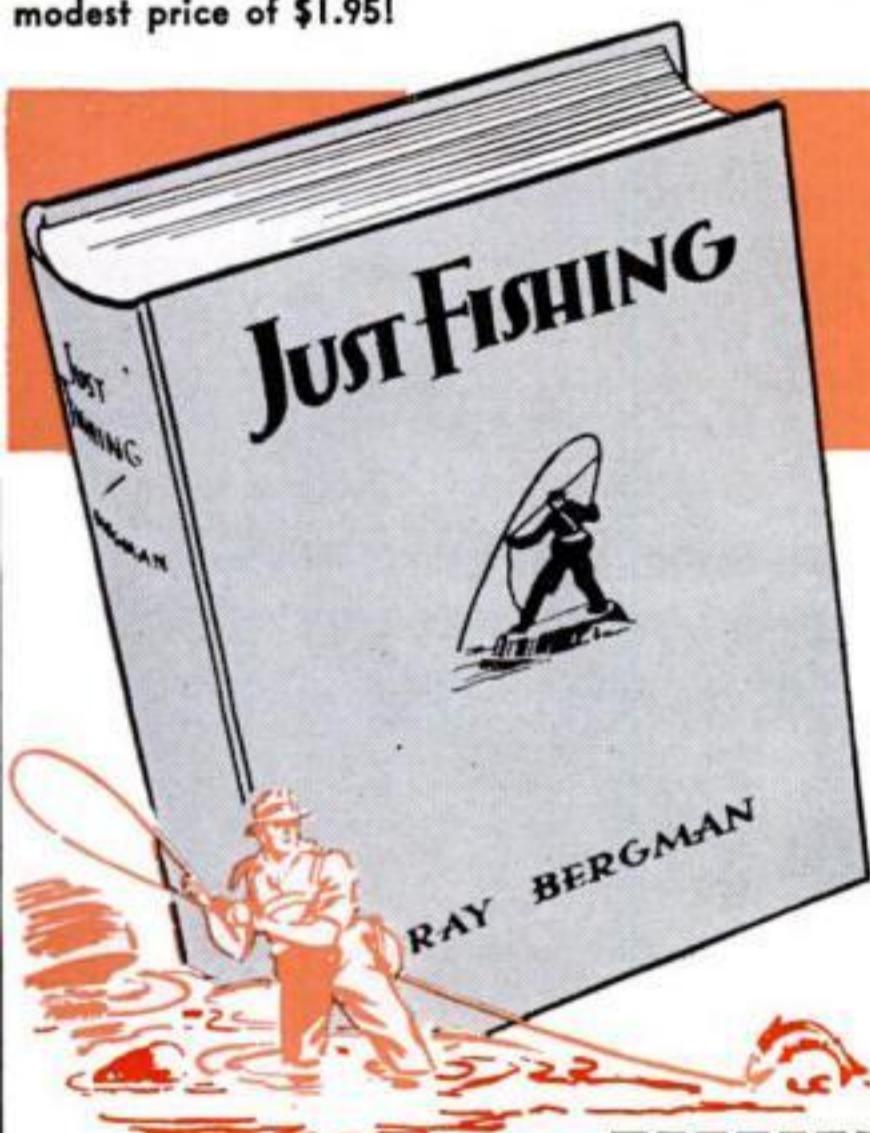
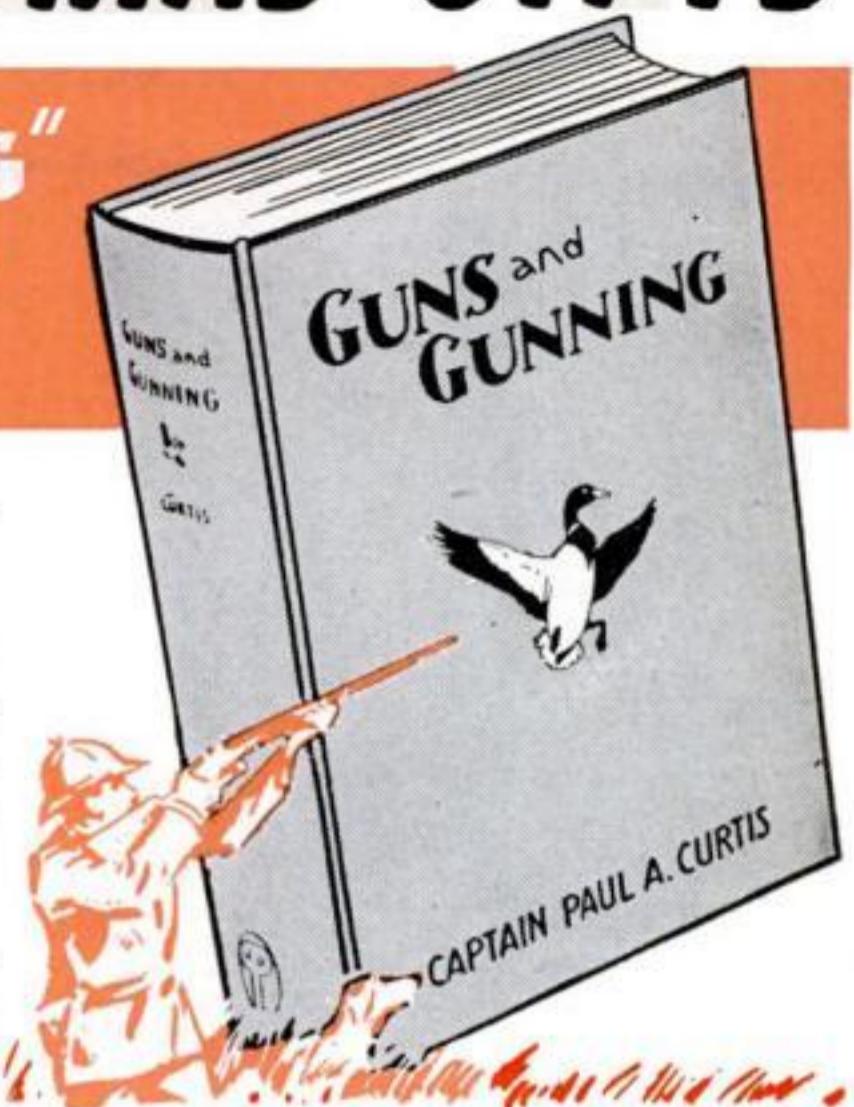
THE MOST COMPLETE GUN BOOK EVER WRITTEN

FORMERLY, \$5.00, NOW ONLY \$1.95

A cyclopedia of information for sportsmen! A reference book that you'll refer to always! A bargain that may never come again!

"GUNS AND GUNNING" brings you hours and hours of stimulating reading about every kind of firearms. Everything you ought to know about rifles and their uses—sights and their adjustment—shotguns with heavy and light loads—the proper choice of weapons and ammunition—how to care for your firearms—skeet and trap shooting—bird shooting—big and small game shooting—is included in this giant 384-page book!

No matter if you are a beginner or an expert, as long as you love guns, you'll find "GUNS AND GUNNING" worth many times the modest price of \$1.95!



## "JUST FISHING"

A BOOK THAT BRINGS THE JOYS OF LAKE  
AND STREAM TO YOUR EASY CHAIR

FORMERLY \$5.00, NOW ONLY \$1.95

The secrets of successful fishing opened up before your eyes! Not just dry theory but actual, workable methods for getting better results.

Beginner and expert alike will learn much from this great book which has rightly been called the fresh water fisherman's Bible. Written in a simple, easy-to-read style, the author pays close attention to details which most writers overlook.

All Eastern game fish and how to get them are fully described—with pictures and illustrations galore. Yet at this temporary low price of \$1.95 "JUST FISHING" costs no more than a few new lures! 418 pages, 17 full-page plates, 80 flies and lures in full colors.

POPULAR SCIENCE, DEPT. 121, 353 FOURTH AVENUE, NEW YORK, N.Y.

Please send me the books I have circled below. I will pay the postman the price shown plus a few cents postage in full payment when the books are delivered. (Money back if not satisfied.)

Fix It.....	\$1.00	Radio Experimenter..	\$2.00	Guns and Gunning..	\$1.95
Electroplating..	\$2.00	Formulas.....	\$1.00	Just Fishing.....	\$1.95

Name.....

Address.....

City..... State.....

If you remit now we pay postage. Orders from outside U. S. A. cannot be sent C. O. D.

SEND NO  
MONEY NOW!  
TEAR OFF AND MAIL  
THIS COUPON TODAY

No dull, futureless job for me...  
I'm getting into  
Airline Maintenance...



Photograph  
courtesy  
Transcontinental  
and  
Western  
Air, Inc.

That's what many ambitious young men are telling us nowadays here at Aero I.T.I. They have heard all about the 'quickie' training that makes you some type of rank and file employee. They say

that's all right for a fellow who wants "just a job" and isn't counting too much on staying in Aviation. But as for themselves, why they're looking at how big the airlines are right today... and how many, many times bigger commercial aviation is going to be. It's the better pay, security, big future, and broad opportunity that counts most with them. These future airline maintenance men are coming to Aero I.T.I. because it's a really big school where they can have every facility, every opportunity, to achieve the skill, to gain the knowledge, necessary to success. Find out—as they did—all about the great future in airline maintenance... and how Aero I.T.I. training can make that great future come true. For complete information... send a letter or postcard NOW.

### AERO INDUSTRIES TECHNICAL INSTITUTE

5247 WEST SAN FERNANDO ROAD • LOS ANGELES, CALIFORNIA



5 COURSES IN  
AIRCRAFT MECHANICS and AERONAUTICAL  
ENGINEERING including 12 Month  
Aircraft Mechanics Course Approved by  
U. S. Civil Aeronautics Administration

#### ADVISORY BOARD

ROBERT E. GROSS  
President, Lockheed  
Aircraft Corporation

JOHN K. NORTHROP  
President  
Northrop Aircraft, Inc.

C. A. VAN DUSEN  
Vice Pres., Consolidated  
Aircraft Corporation

## RADIO COURSE BOOK

FOR HOME-STUDY

### RADIO SERVICING COURSE MANUAL

22 Complete Lessons  
243 Practical Hints  
Data on 210 Radio Tubes  
Large size: 8 1/2 x 11 in.  
Printed in 1941.



**WORTH MORE**  
"You should get more money for the course. The first week I studied, I made \$10 repairing sets. I have repaired 100 radios to date." Robert C. Hammel, Davenport, Iowa.



**EASY TO MASTER**  
"I started to repair radios when I was on the 12th lesson. It took me two months to master your course." Roger Langlois, Montreal, Canada.

ONLY  
12¢ A  
LESSON

#### GET A GOOD JOB IN RADIO

With radio training you can quickly obtain a good paying job. This course manual has helped others like you to secure work in radio servicing, transmitter operation, national defense. These money-saving lessons will give you essential training needed. Includes extra information on short-wave, television, signal-tracing, and auto radios. You may examine the complete manual, containing all the lessons and review questions, in your own home without any risk or obligation.

#### PRACTICAL INSTRUCTIONS

The lessons are practical, clear, interesting, easy to master and use. No special education or previous experience required. You will enjoy learning important radio facts and doing real radio service work after the 14th lesson.

#### SATISFACTION GUARANTEED

Take advantage of our "no risk" trial offer. Send only 25¢ now. You will receive the complete Radio Course Book for 10 days examination. Begin your radio study without obligation. If you are pleased the complete Course Manual is yours to keep for only \$2.50, full price. Send coupon with 25¢ now—study the first lessons this week.

## 25c TRIAL ORDER COUPON

SUPREME PUBLICATIONS, 328 S. Jefferson St., Chicago, Ill.  
Ship the complete "Radio Course Book" for 10 days use. I am enclosing 25¢ in coin or stamps and will deposit \$2.25, and a few cents postage, with the mailman. I must be satisfied or you will refund my money in full.

NAME: ..... PS-D-C

ADDRESS: .....  
Send \$2.50 now and receive complete "Course" postpaid. You save postage.

## AMAZING NEW ELECTRIC ARC WELDER

FULLY  
GUARANTEED

RETAILS  
ONLY  
\$2 95  
COMPLETE



#### Plugs Into Light Socket

Amazing new HANDIWELD Electric Arc Welder—operates from 110 volt, A.C. or D.C., same as other arc welders higher priced—generates tremendous heat to weld all kinds of metal. Not a toy welder that uses carbons, but actually uses standard coated rods—sizes 1/16" and 3/32". Generous supply furnished with welder. Guaranteed not to burn out. Repairs fenders, auto bodies, radiators, preheated small castings and machinery parts. Take HANDIWELD anywhere to job, operate from light socket. Sturdily built of finest materials to last years. Fully guaranteed by Big Manufacturer. **SEND NO MONEY**—You'll find a thousand uses for the HANDIWELD around your home, garage, work shop. Also by garages, factories, repair shops, farmers, inventors, tin shops, plumbers, etc. Order HANDIWELD now. Send no money. We'll rush one to you, complete with rods and goggles. Pay postman only \$2.95 plus few cents postage. If not delighted, return HANDIWELD in 5 days from receipt and money paid for it will be refunded instantly. Rush your order now. KUMFY PRODUCTS INC., Dept. A-205 Cincinnati, O.

## don't WORRY



Why put up with years of needless discomfort and worry? Try a Brooks Automatic Air Cushion. This marvelous appliance permits the opening to close, yet holds reducible rupture securely, comfortably—day and night. Thousands report amazing results. Light, neat-fitting. No hard pads or stiff springs to chafe or gouge. Made for men, women and children. Durable, cheap, **Sent on trial** to prove it. Never sold in stores. Beware of imitations. Write for Free Book on Rupture, no-risk trial order plan, and proof of results. All correspondence confidential.

**BROOKS COMPANY, 160 State St., Marshall, Mich.**

## LEARN TO MAKE NOVELTIES LIKE THESE!



#### 1000% PROFIT EASY!

No experience necessary. We provide complete instructions and all materials needed. Turn your spare time into money. Use

#### STEWART'S RUB-ER-SPRA

The finest mold-making material available and make the most money from small investment.



**FREE** → BIG Illustrated BOOK fully explaining big paying novelty-making business. Send for it today!

**STEWART'S STUDIO, Dept. PS-12, 1008 George St., Lake Geneva, Wis.**

## WE CAN TEACH YOU TO MOUNT BIRDS

### Squirrel Lighter



### ANIMALS, HEADS, FISH

Also to tan skins and FURS. Easily learned **AT HOME BY MAIL**. Wild game growing scarcer—big demand. Be a taxidermist. Mount for others. Big Fun. Real Hobby. Mount common specimens—no wild game needed.

**REAL PROFITS IN SPARE TIME.**

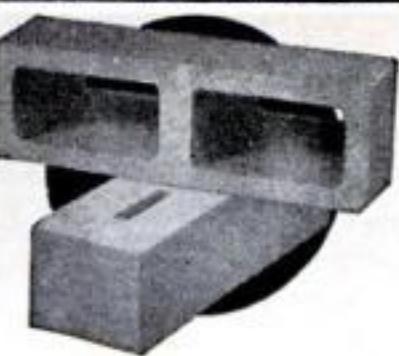


**FREE BOOK** Men, Boys, get wonderful

FREE BOOK—tells how **YOU** can learn this fine art quickly. Investigate. Send this minute. State **AGE**.

**N. W. SCHOOL OF TAXIDERMY, Dept. 3399 OMAHA, NEB.**

## MAN WANTED



### In Protected Territory to Manufacture New Building Unit

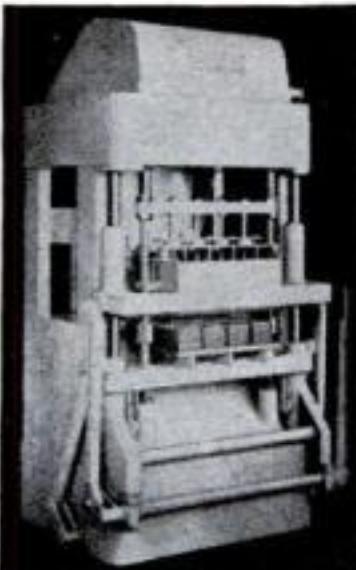
Brikcrete is America's newest and finest masonry unit. Combines great strength with light weight. Colorful, air-insulated, modern. Twice the size of brick; half the weight. Can save one third over brick construction. Keys in with today's demand for a permanent low-cost material for home building.

#### Be First!

Manufacturing Brikcrete is a lifetime opportunity. Uses local, low-cost materials and common labor. Broad market; high income possibilities. We supply complete equipment. Small investment starts you. Exclusive privileges. Be first in your territory to get "The Brikcrete Book." Write today.

Brikcrete Associates, Inc.

4675 Division Avenue, S.  
Grand Rapids, Michigan



## FREE

### BARGAIN CATALOG of BOOKS

25,000 books of all publishers listed in our 47th Annual Bargain Catalog of 320 pages. Old-time favorites—latest "best sellers." Reference, Fiction, Juvenile, History, Scientific, etc. Supplying schools, colleges, libraries and thousands of individual customers. Send postcard today for our new 1942 catalog, "Bargains in Books."

THE BOOK SUPPLY COMPANY, DEPT. 145  
564-566 West Monroe St. Chicago, Ill.

## Learn TOOL DESIGN

Qualify quickly as a Machine Tool Designer by home study in spare time. Entire defense program depends largely upon the machine and tool designer. After defense boom machine and tool designers will be equally necessary for reconstruction. Many now making \$100 to \$125 a WEEK. Rapidly expanding industry calling for more machine and tool designers than now available. Learn quickly with our step-by-step lessons supervised by a recognized professor of machine tool design. Rush name and address today for FREE 3 weeks training in either Machine or Tool Design. Then decide whether you want to continue. No obligation. State age to get free lessons. A penny postal will do—but hurry.

R. WENDELL DUNKLE, Dept. 37, Ohio Institute of Technology, Greenville, Ohio

## LEARN MONEY-MAKING CARTOONING

Same simplified method that has helped train creators of "Terry & Pirates," "Wash Tubbs," "Out Our Way," "Winnie Winkle," "Reg'lar Fellers," "Strange As It Seems," "Secret Agent X-9," and many others. Earn while learning. Rush 10c for Picture Chart (to test your ability,) and full details. (State age). THE LANDON SCHOOL, Dept. 4132, National Bldg., Cleveland, O.



When Writing Advertisers  
Please Mention POPULAR SCIENCE

## TRAIN FOR Radio in 8 WEEKS

### I WILL

### FINANCE YOUR TRAINING

Prepare for opportunities in Radio by 8 weeks of practical shop work in the great Coyne Radio Shops, on real RADIO equipment. You don't need advanced education or experience. Free Employment Service for life. Many earn while learning. Mail coupon today for free book which tells you how hundreds have become successful Radio Men after taking our training.

H. C. LEWIS, Pres., RADIO DIV., Coyne Electrical School  
500 S. Paulina St., Dept. 91-4H, Chicago, Illinois

Send Free Radio Book and facts. Tell me about your "Pay-Tuition-After-Graduation" Plan.

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_

DECEMBER, 1941

Please mention POPULAR SCIENCE MONTHLY when writing to advertisers.

## HEAR 'EM CHOO-CHOO



## AMERICAN FLYER TRAINS

### FREE—48-page book

Big illustrated book gives complete advance news on new American Flyer "Choo-choo"—first device that accurately reproduces the stirring sound effects of real trains. Choo-choos are so realistic they change tone and tempo with every change in train speed. Slow, deep-throated choo-choos when train is standing idle . . . racing, roaring choo-choos at high speeds. Can be heard over 100 feet. Book also describes new worm drive locomotives, mail pick-up car, army unloader car, "build-'em-yourself" kits and other spectacular features. Mail coupon or post card to American Flyer Trains, 414 Erector Square, New Haven, Connecticut.

Name .....

Street .....

City ....., State .....



★ This brand new encyclopedia "AVIATION" is just off the press and is the finest, best illustrated and most complete encyclopedia on this subject we have ever published. Beautifully bound in modernistic washable cloth. Covers the whole field from first principles of flight through latest types of engines, meteorology, aircraft instruments and how to read them, gliding, parachute packs, etc. Every man interested in flying, whether amateur or expert, should have these books; sent for free examination, no money down, no deposit.

## Wonderful New Field

National Defense has opened up tremendous opportunities in Aviation. It is the fastest growing industry today. Huge new plants are being built. Get into this field now. Send the coupon for free examination. Get this brand new up-to-the-minute encyclopedia NOW.

American Technical Society, Dept. H-920  
Drexel at 58th St., Chicago, Ill.

Send for 10 days' trial brand new 6 volume set, Aviation. I will pay the delivery charges only. If I wish I may return books in ten days and owe you nothing, but if I decide to keep them I will send \$2.00 after 10 days, then only \$8.00 a month until \$19.80, the total price, is paid. Send brand new edition which includes Aviation Blueprint Reading and free consulting service for one year.

Name .....

Address .....

Please attach letter, stating age, occupation, employer's name and address and that of at least one business man as a reference.

# WONDERS OF AMERICA

Sound  
Wizards

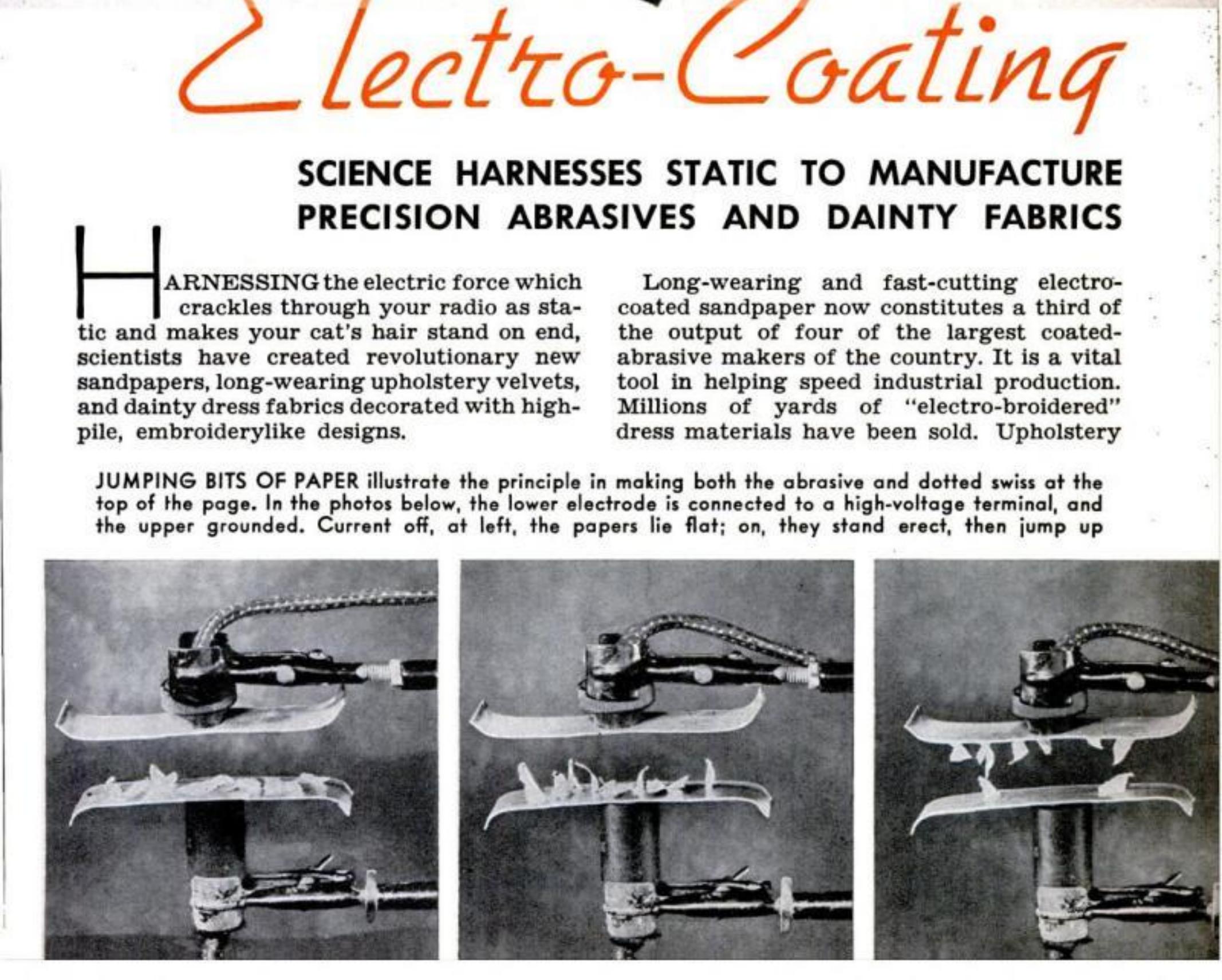


IN RECENT LABORATORY "SMOKING BOWL" TESTS, PRINCE ALBERT BURNED **86 DEGREES COOLER** THAN THE AVERAGE OF THE 30 OTHER OF THE LARGEST-SELLING BRANDS TESTED—COOLEST OF ALL!





*Sandpaper*



*Fabrics*

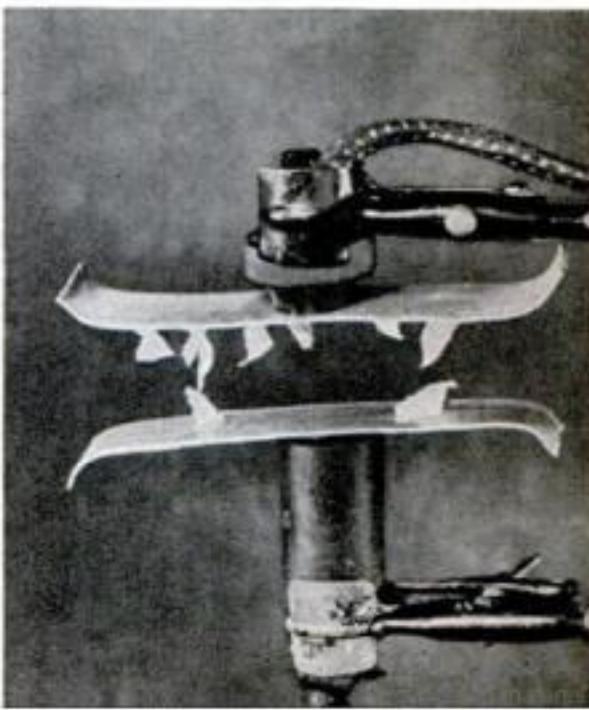
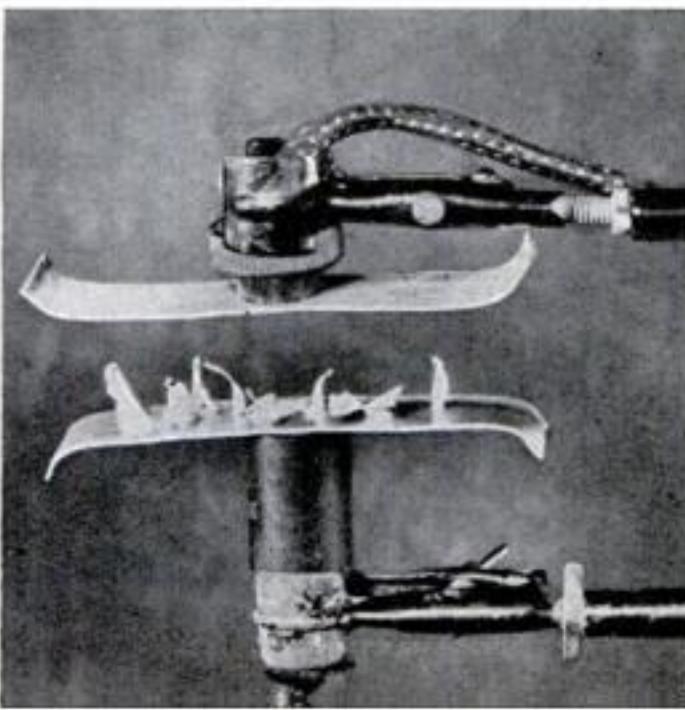
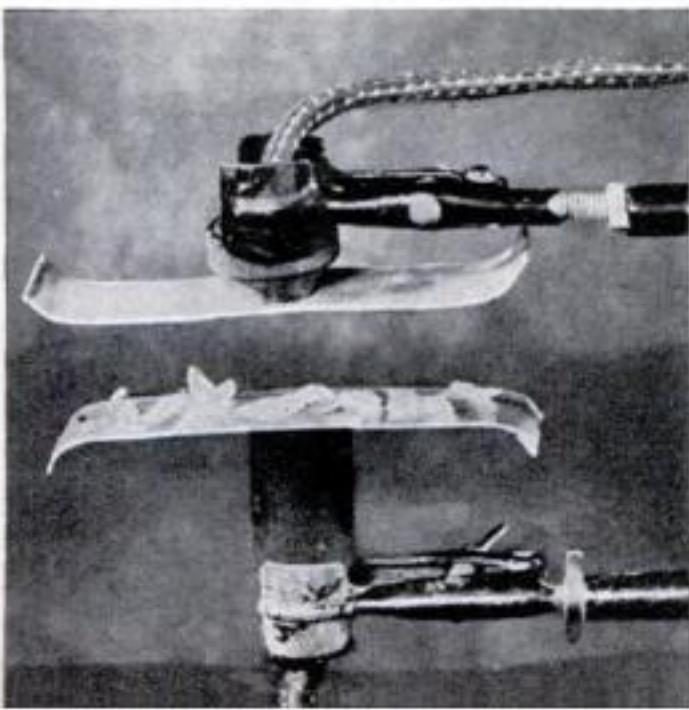
# *Electro-Coating*

**SCIENCE HARNESSES STATIC TO MANUFACTURE  
PRECISION ABRASIVES AND DAINTY FABRICS**

**H**ARNESSING the electric force which crackles through your radio as static and makes your cat's hair stand on end, scientists have created revolutionary new sandpapers, long-wearing upholstery velvets, and dainty dress fabrics decorated with high-pile, embroiderylike designs.

Long-wearing and fast-cutting electro-coated sandpaper now constitutes a third of the output of four of the largest coated-abrasive makers of the country. It is a vital tool in helping speed industrial production. Millions of yards of "electro-broidered" dress materials have been sold. Upholstery

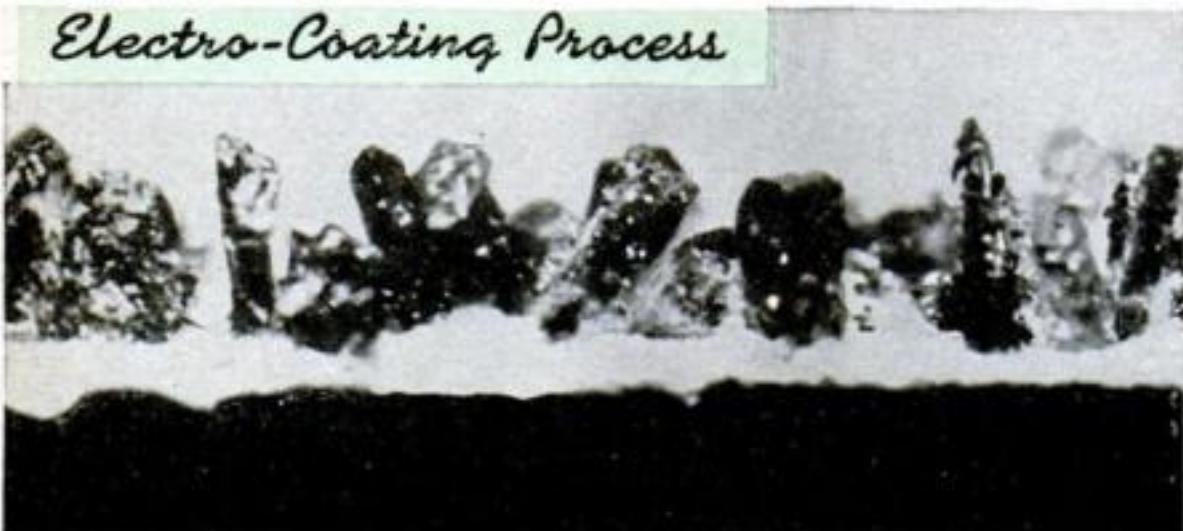
JUMPING BITS OF PAPER illustrate the principle in making both the abrasive and dotted swiss at the top of the page. In the photos below, the lower electrode is connected to a high-voltage terminal, and the upper grounded. Current off, at left, the papers lie flat; on, they stand erect, then jump up



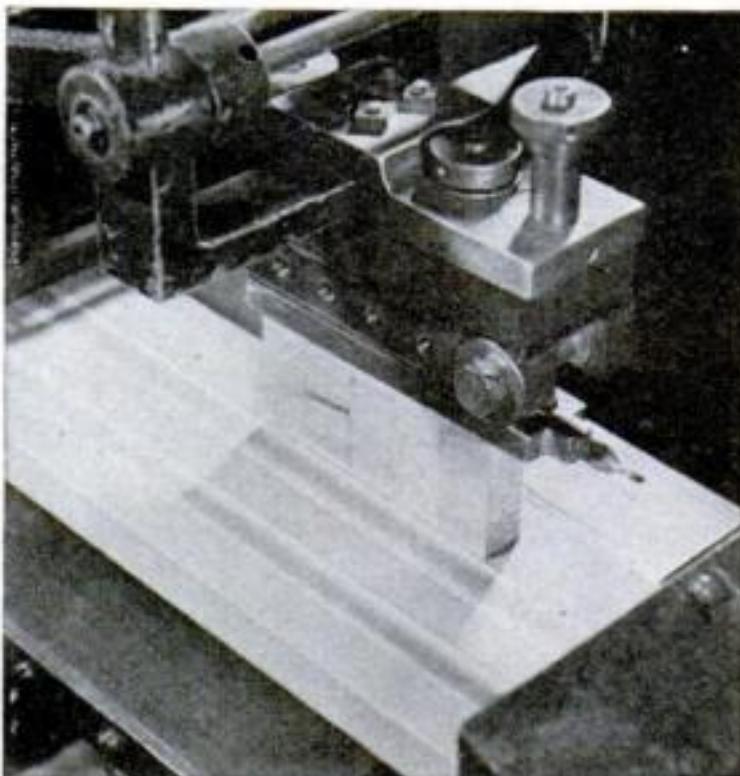
## Regular Process



## Electro-Coating Process



PHOTOMICROGRAPHS at left show a cross section of ordinary gravity-coated sandpaper and of electro-coated paper. Note how erect grains are on the latter. The machine below tests cutting



velvets are not yet available commercially, but tests show them to be as much as three times as wear-resistant as woven velvets.

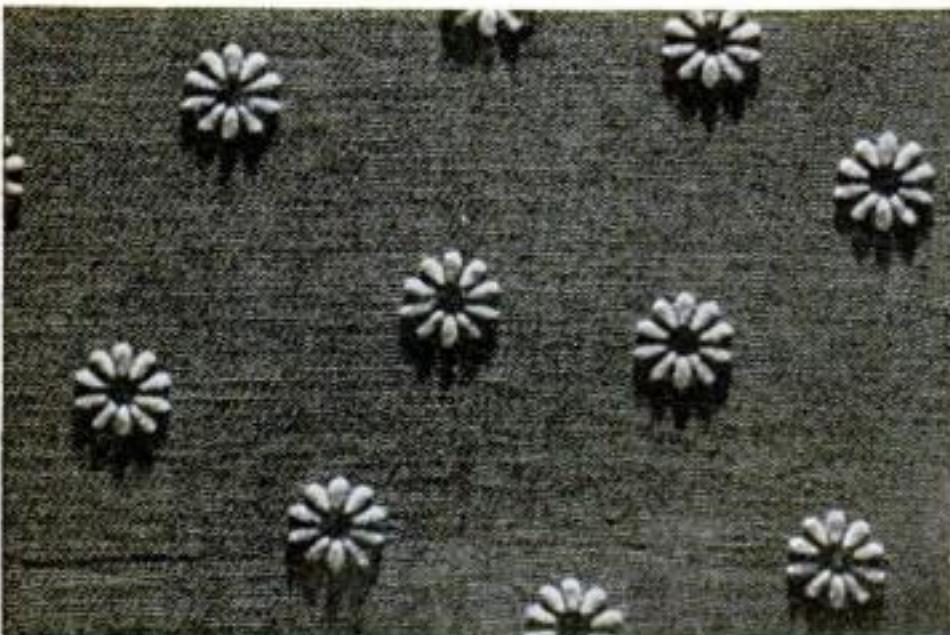
Oddly enough, the principle involved dates to man's first knowledge of electricity. Thales, a Greek philosopher of 600 B.C., knew that rubbing a piece of amber would cause bits of straw or feathers to stand on end and jump to it. After 2,500 years, E. C. Schacht, of the Behr-Manning Corp., Troy, N. Y., one of the largest sandpaper makers in the world, conceived the idea of using static electrical force to make a better sandpaper on which all grains would stand on end.

Here is how it works: The abrasive grains are dropped onto a belt which carries them between two electrodes connected to a rectifier or a transformer. An adhesive backing is passed beneath the upper electrode. Entering the electric field, the grains first stand upright, then are repelled from the

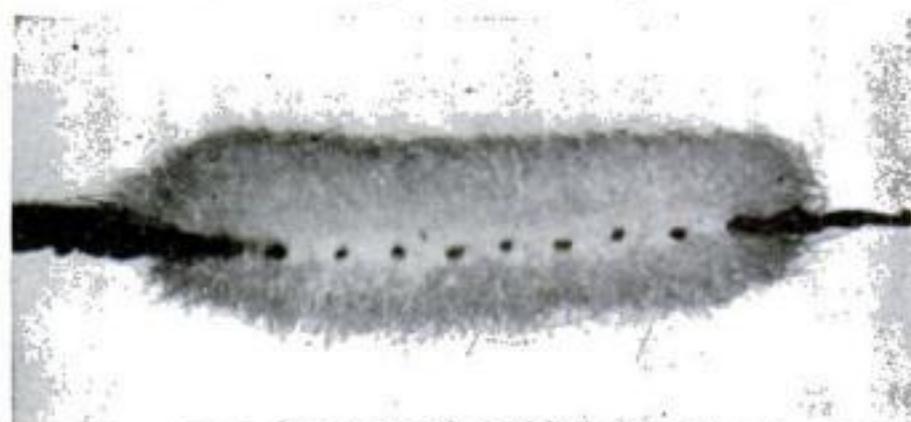
lower electrode and shot upward to the adhesive backing, where, all being charged, they repel each other, spacing themselves uniformly. Cutting was improved from 20 to 50 percent.

Today, electro-coated abrasives are found on many big metal and woodworking jobs. Coated with aluminum oxide and silicon carbide, the hardest abrasive grains, they are sold under the brands of Lightning, Electro-Coated, and Elec-Tro-Cut. For precision, abrasives, backings, adhesives, and the coating process are under constant watch. At the Behr-Manning plant, forty engineers and chemists maintain the check.

Abrasives, received in lumps, are crushed to grit and screened in grain sizes ranging from those that pass through a mesh of 12 to the inch to specks about  $1/2,500$  inch across. The finest screened size, No. 240, goes through a mesh with 57,000 openings



ELECTRO-BROIDERY on dress goods, at left, is an example of the high-pile designs made possible through the use of static. Below, a cross section of one of the electro-coated dots. The fibers go right through the fabric



to a square inch. Still finer grains are prepared by water classification or by air flotation, taking advantage of the fact that coarser grains settle more rapidly in either water or air than the finer grains.

Paper backing is made from rope, wood pulp, or jute in several weights. Jean or drill cloth backs are used where operations require more strength or flexibility. Both must pass rigid tests. The adhesive is a special hide glue or a synthetic resin.

The paper or cloth is fed into the "making" machine, which may carry a run of 100,000 yards or 60 miles, without a stop. Adhesive is applied, and the grains are shot into it through the electrostatic field. The material then goes to drying racks, getting there an anchor coat of glue. After final drying, it is wound into rolls.

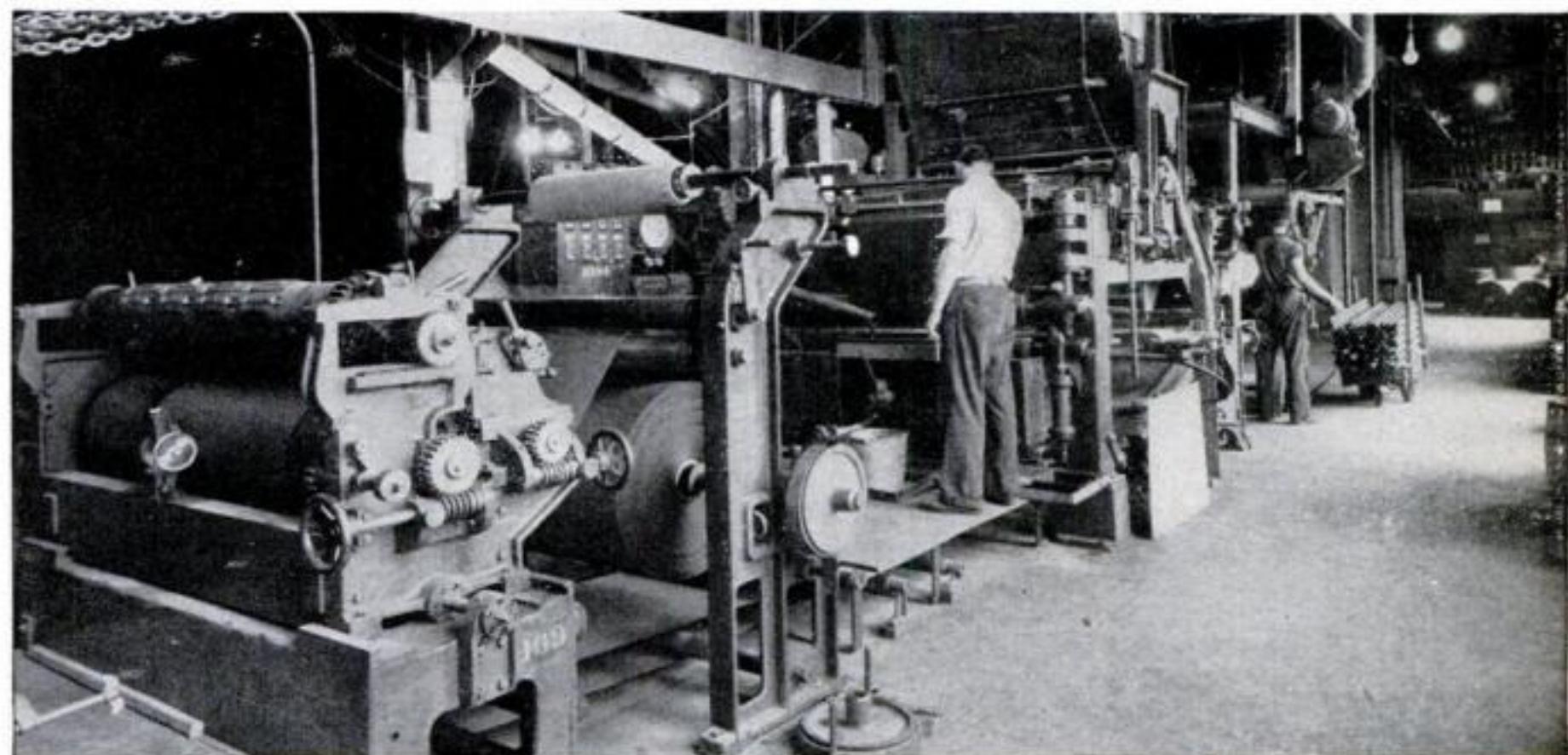
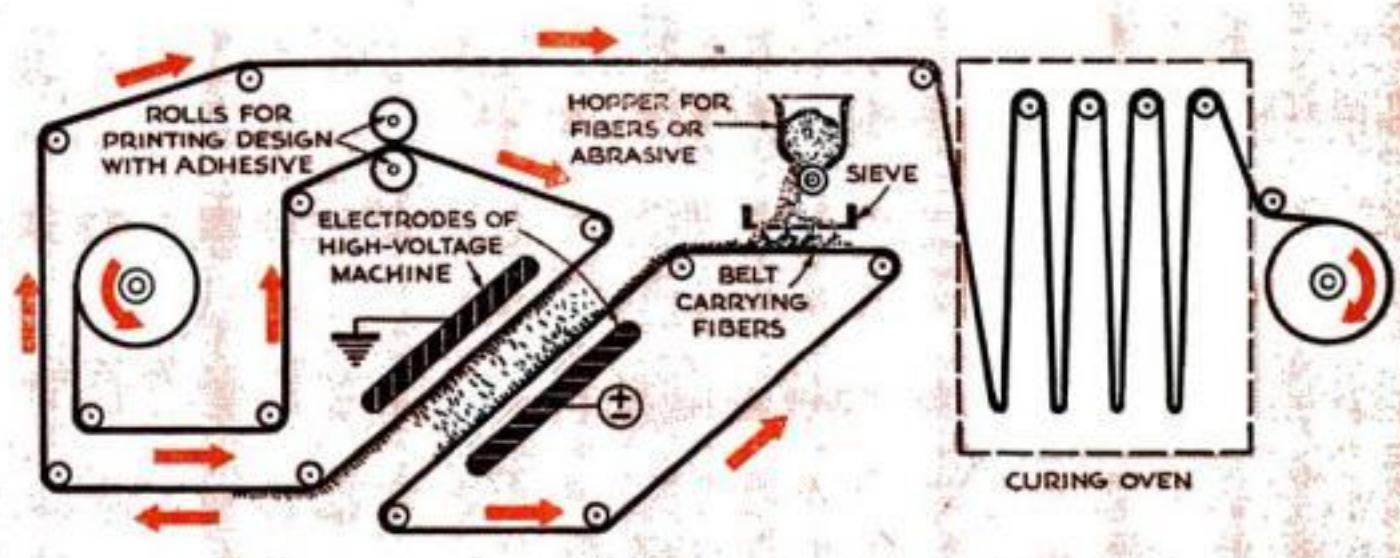
From coating fabrics with abrasive grains to coating them with textile fibers seemed an obvious step, and more years of experimentation produced electro-coated textiles. Direct current, which worked with abrasives, caused bothersome clinging together of fibers, but alternating current made the fibers dart up and down between the electrodes, sticking only when caught by the

adhesive, which itself was a problem. The materials must remain soft and pliant and withstand laundering, dry-cleaning, and ironing. The final choice was a series of thermo-setting resins that could be varied in flexibility to suit a particular need. The adhesive is applied to the material in the required design. When moved into the electric field, fibers, cut to lengths of from .025 to .06 inch, are shot into the material, penetrating to a depth determined by the charge and the adhesive. They stand evenly on end, often packed in at from 250,000 to 300,000 to the square inch.

The first commercially manufactured electro-broidered dress goods, called Fibredown, are lawns and voiles, figured with raised designs of cotton, rayon, silk, or wool in one or more colors. They are manufactured under a license from the Behr-Manning Corporation.

Norzon, simulated velvet, is being made on a small scale. Liquid latex makes a flexible and durable adhesive here for holding the fibers to the backing. Electro-coated rugs and carpets, with  $\frac{1}{4}$ -inch pile, are being tried with indications of a promising future.

**WHILE COMPLEX** and big, the "making" machine below really is an instrument of delicacy, and sixty miles of sandpaper will go through it on one run. Adjustment is automatic. The schematic diagram at the right shows how the apparatus does its work



# Night Watchmen of the Skies

Ingenious Machines Aid Army Searchlight Crews in Air-Raid Protection



Members of a U. S. Army antiaircraft searchlight unit man one of the new three-horn sound locators that unerringly spot night-flying bombers

By JOHN WATSON

**D**ARKNESS and silence cover the scene—the Coast Artillery area guarding a seaboard city—and the activities of the day seem long since to have ended. But in an isolated section, far away from the big-gun emplacements and the barracks, a small group of men are engaged in quiet, intense work. They are the watchdogs of the Army, members of an antiaircraft

searchlight unit, whose job is to detect, track, and illuminate raiding enemy planes and keep them illuminated while crews of antiaircraft gun batteries blast them from the skies.

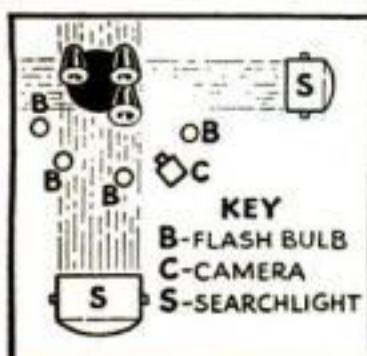
It is an eerie job. A layman observer, permitted to witness a night of practice, sees long lines of cables snaking through the sandgrass, leading from an instrument that looks like a botanist's nightmare—a cluster of weird, mechanical bell-shaped flowers—to other devices that appear squat and formless in the dark.

He sees helmeted men attach themselves to the flower cluster by means of thumb-thick tubes, like an insect's antennae, which are fastened to each helmet's ears and connect with the center of the instrument. He watches the men twist wheels which elevate the flower-shaped horns or turn them horizontally.

He learns that the snakelike cables are transmitting electrical impulses which carry information to one of the squat instruments, 500 feet away, where other men

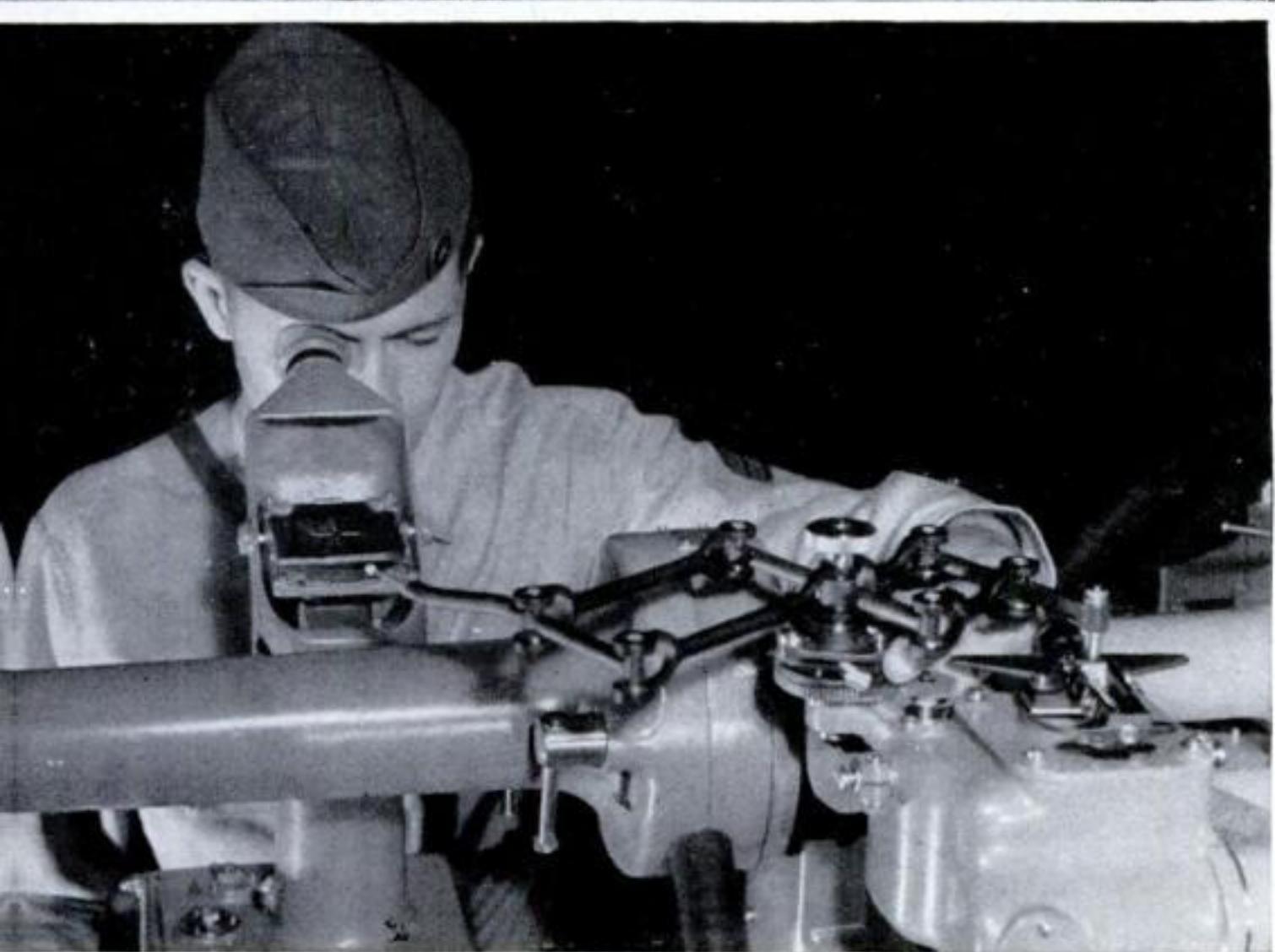
## Our Cover

The antiaircraft sound-locator crew on the cover was photographed in the glare of two searchlights, as shown in the drawing. Outdoor Kodachrome film, 1/2-second exposure, f/22. The photograph above was made under similar conditions, except that indoor Kodachrome film was used.



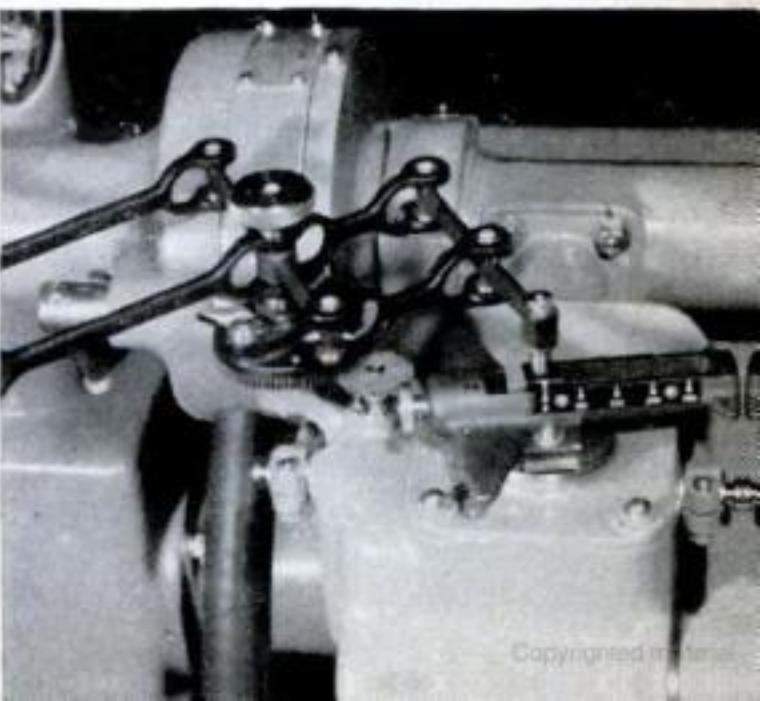
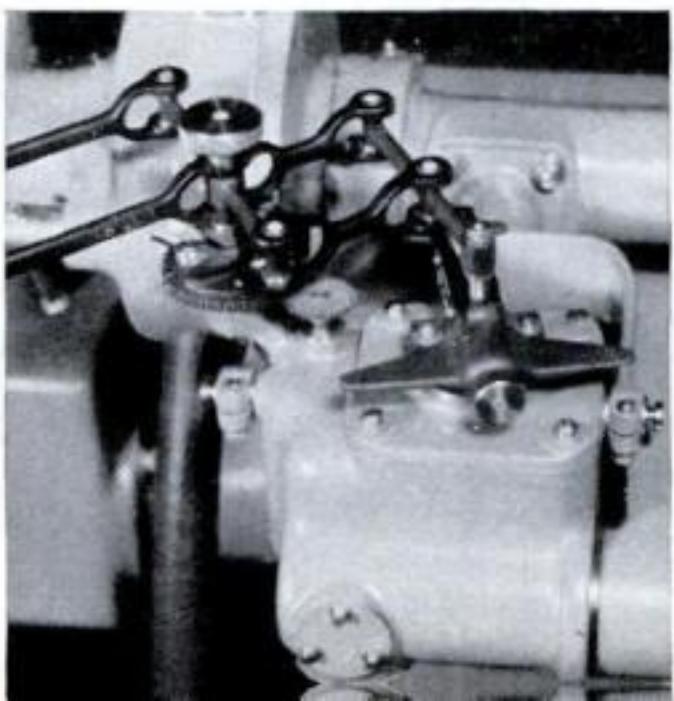
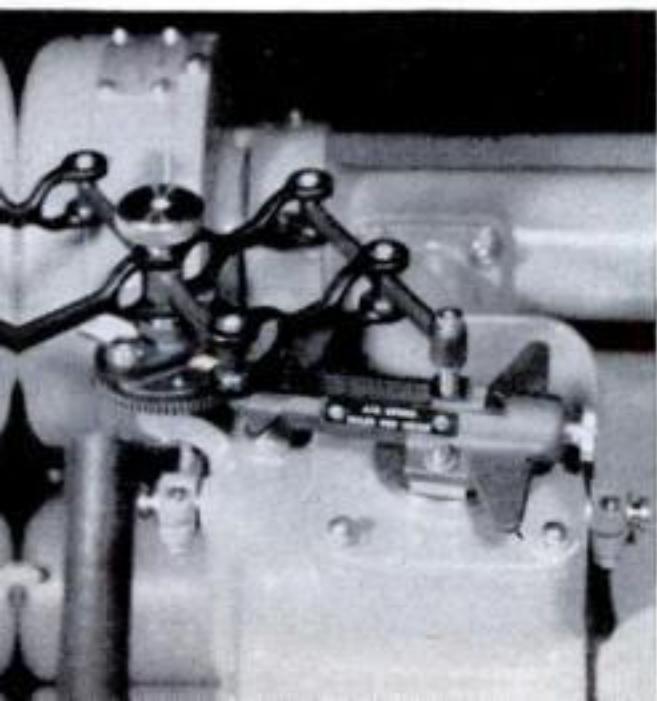


Each listener hears sounds picked up by one of the horns; the other horn is common to both. Together, they fix the point from which sound comes.



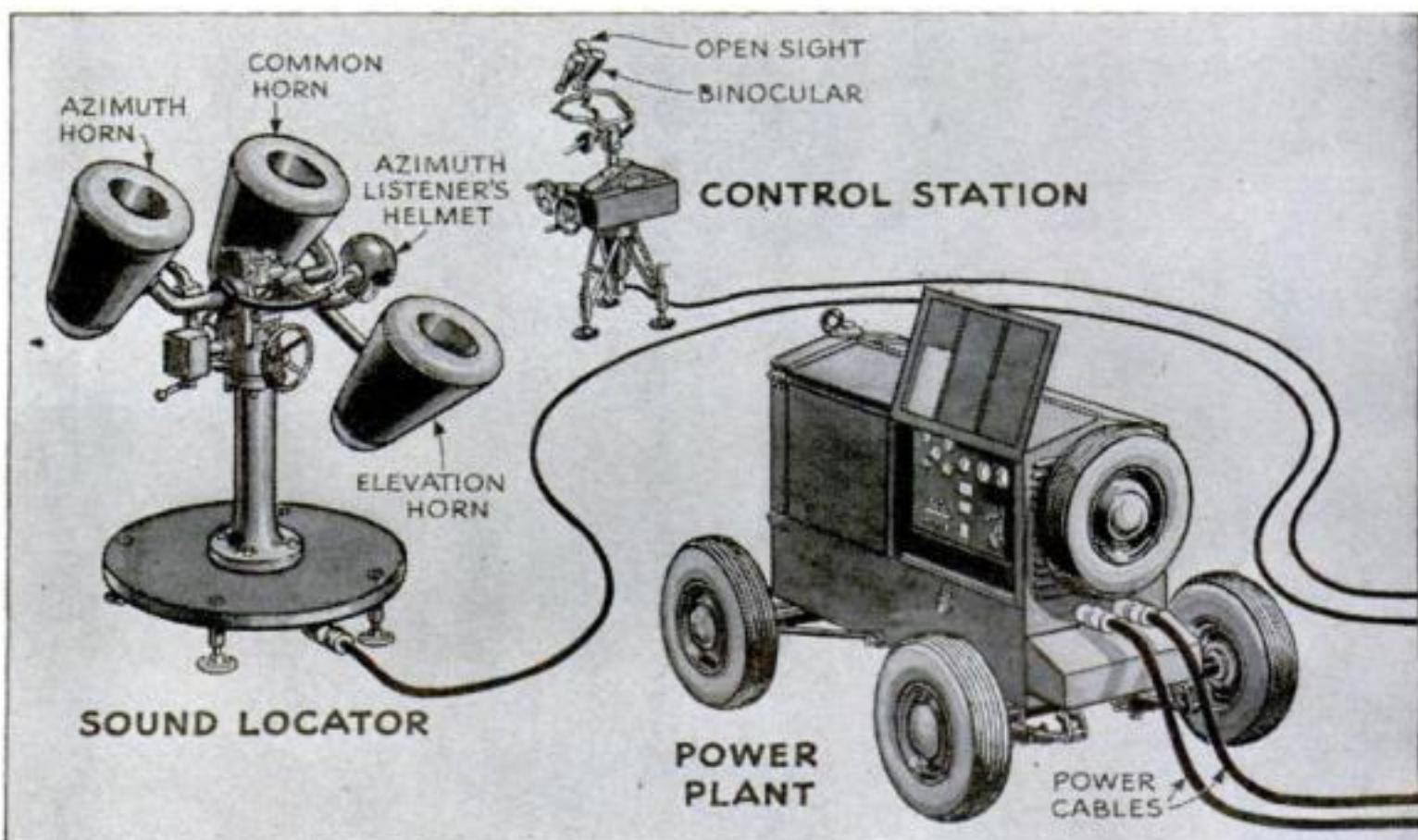
**THE CORRECTOR** compensates for sound lag, the distance the plane travels before the sound reaches the sound locator; wind error, directional changes in the course of the sound caused by the wind; parallax error, created by the ideal tactical disposition of the sound locator and searchlight nearly 1,000 feet apart. Sighting in a mirror, he centers marks on the mirror on a ball at the end of the pantograph that makes correction for all these errors

A miniature plane, part of the speed-corrector assembly to which the pantograph is attached, serves as a visual indication of the course of the target. A speed-corrector scale on its side is graduated in m.p.h.

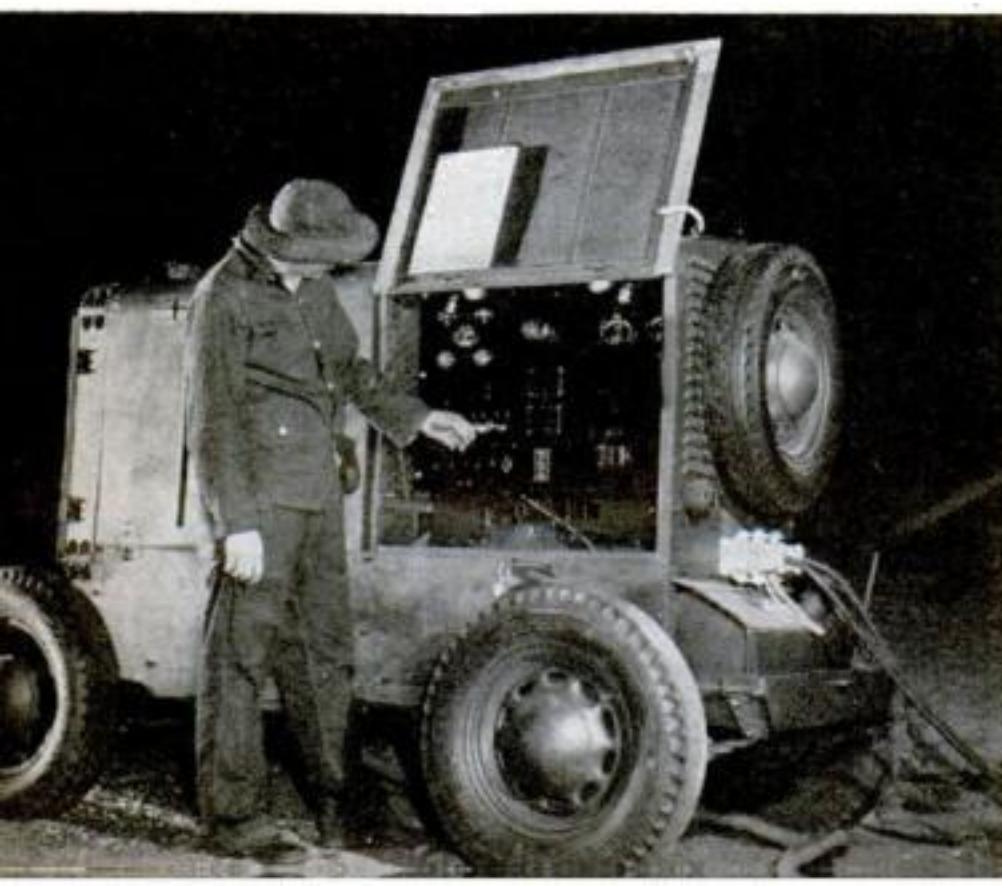




**CONTROL STATION** aims the searchlight according to data from the sound locator. By turning a hand wheel, an operator keeps a needle on the zero point of a dial to train the light on the spot indicated by the locator. At the same time, the binoculars are trained on the target. When the plane is "flicked," the observer tracks it for elevation and azimuth by manipulating hand controls

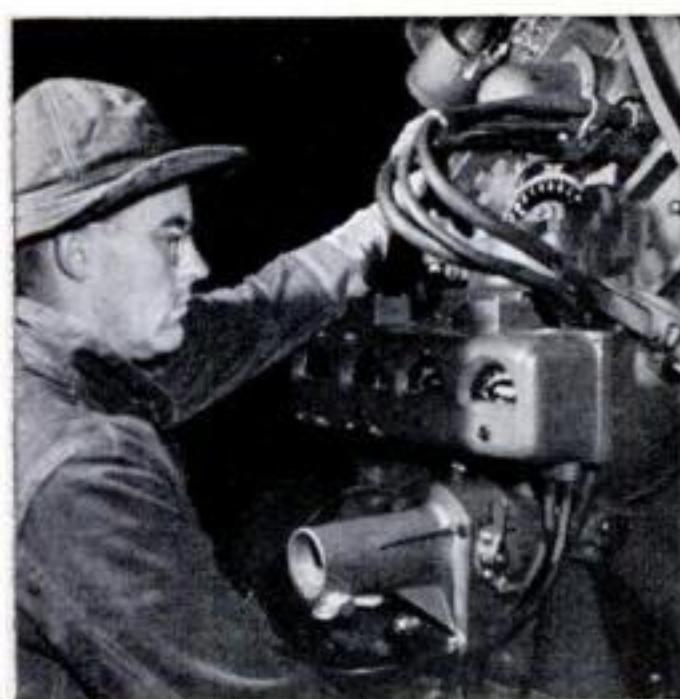


**POWER PLANT**  
Current for the light comes from a mobile unit consisting of an air and water-cooled gasoline engine driving an electric generator that delivers about 150 amperes at 78 volts. Carried or towed to the scene of action by a truck, it is managed by one man

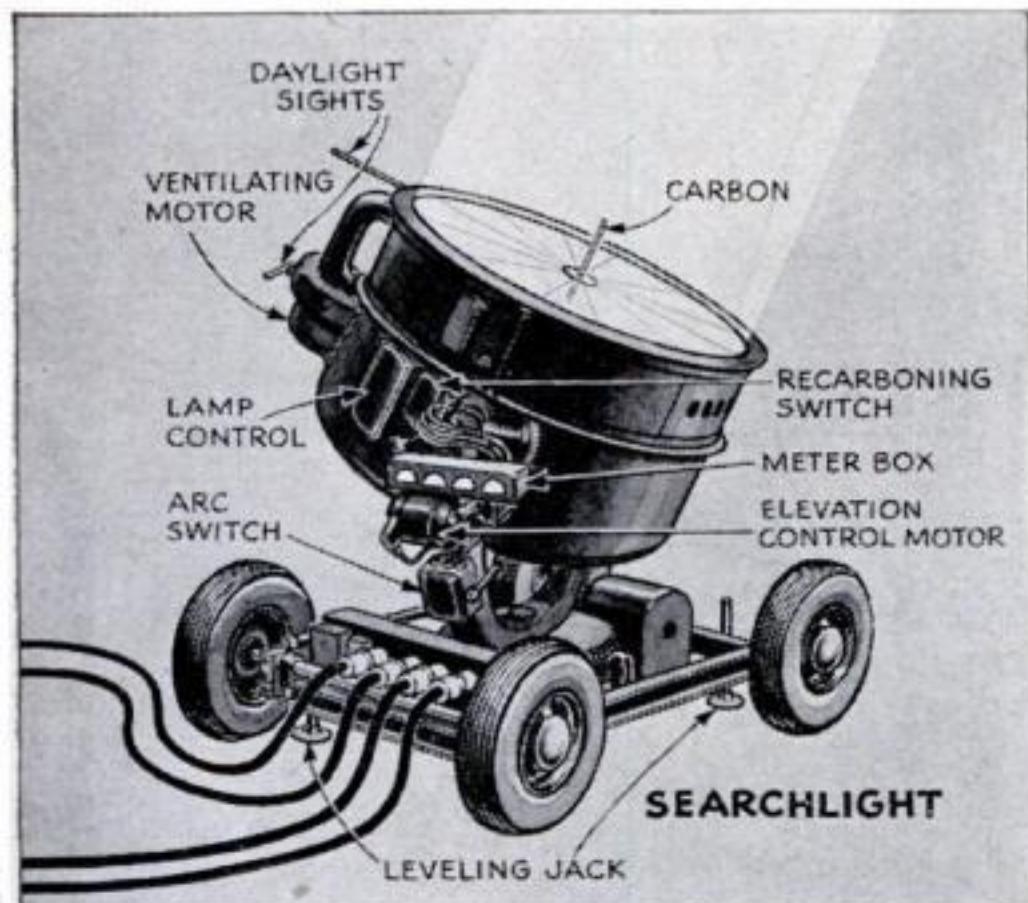
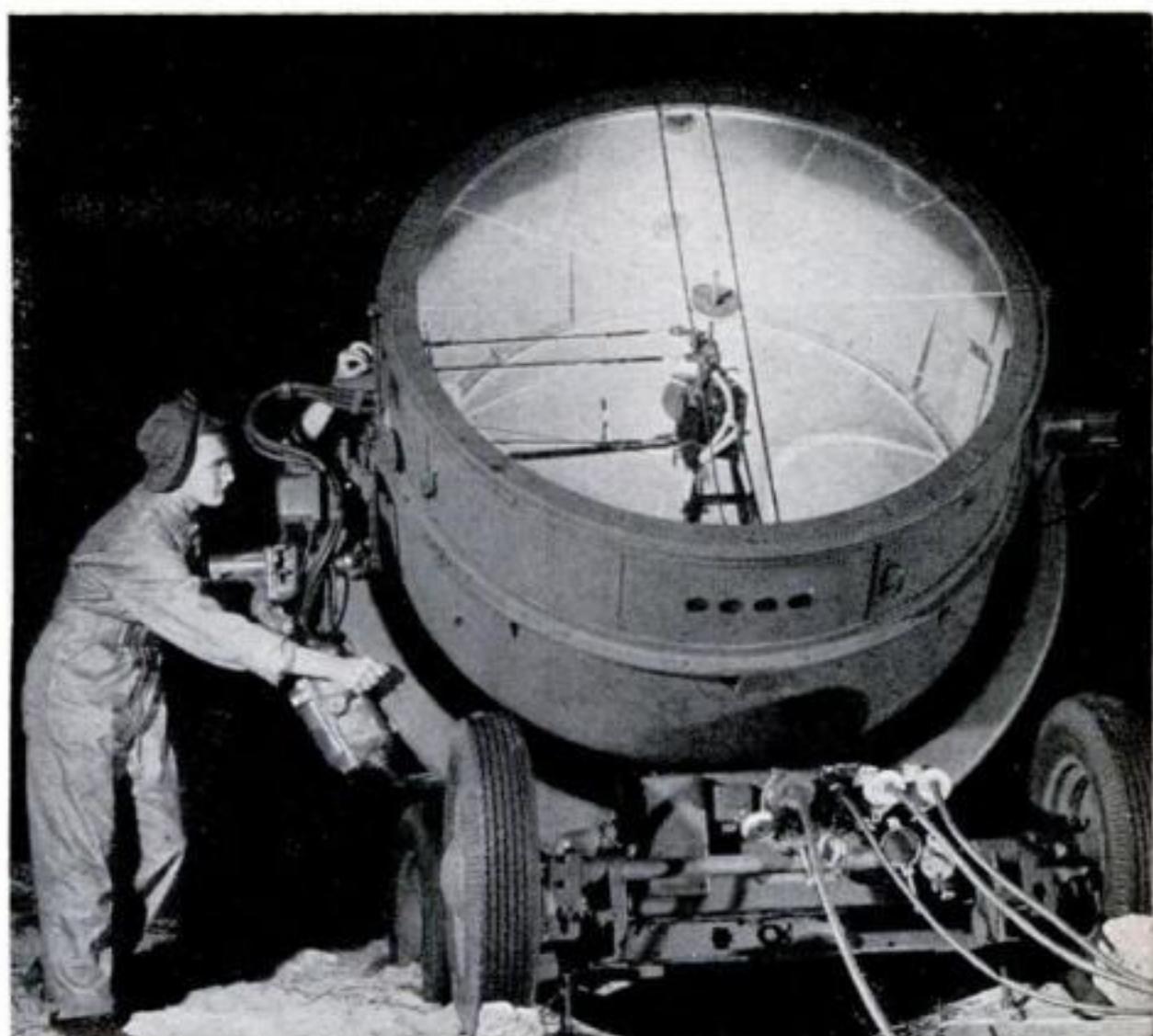


turn wheels and fasten their gaze on dials. He hears the chief of section of the unit give a brief command and suddenly, from a thing that has been dark and dead, perched atop a sand dune, shoots a blinding beam of light—and in the center of that beam, thousands of yards from the ground, the murderous throb of a bomber's motors is transformed in an instant into a clearly distinguished plane. The target has been "flicked" dead center.

To "flick" so fast and elusive a target as a plane demands a high degree of coördina-



THE SEARCHLIGHT is an 800,000,000-candlepower carbon-arc lamp on wheels. In addition to being automatically aimed from the control station, it can be manually operated by one man using a 12-foot control rod and reading azimuth and elevation on illuminated dials. Range: 6,000 to 12,000 yards



tion and an immense amount of practice. The problem of the Army's watchdogs, in its essentials, is to pick up the sound of an enemy plane as far away as possible, determine its position and direction, track it as it approaches, and illuminate it at the earliest possible moment so that the gunners of the antiaircraft batteries will have something to shoot at.

The first business in hand on this night in the sand dunes is the botanist's nightmare, the sound locator. In its newest development this consists of three bell-shaped

horns attached to a metal column which rests on a platform. The horns are designed to act as huge extensions of the human ear.

The three horns form a triangle and the middle horn is common to the other two. That is, the middle horn is paired with the bottom horn to obtain the elevation of a plane, and with the top outside horn to obtain azimuth, or the horizontal angle, and thus establishes direction. The old-style sound locator had four horns, two for elevation and two for azimuth, until it was discovered that one horn could be made to do the work of two.

Two helmeted men, their headsets attached to tubes leading from the hearing mechanism, face each other on the platform. One, who is the elevation listener, turns a small handwheel and raises or lowers the horns until the thrum-thrum-thrum of the plane's motors seems to be directly in the center of his brain, neither stronger toward the left ear nor stronger toward the right. When he has centered the sound he knows he has the horns set correctly to obtain the elevation of the plane.

Similarly, the second man, who is the azimuth listener, turns his handwheel and moves the horns in a horizontal circle until he, too, has centered the sound in his head and knows that he is on the correct azimuth.

But there is one very important calculation still left out, which requires the presence of a third man, who is known as the

corrector operator. Since sound travels at about 1,100 feet a second it is obvious that when the hum of a plane's motors reaches the locator, the plane has traveled a considerable distance from the spot where the horns would place it.

To correct this sound lag, a small device known as a pantograph is a part of every locator. The pantograph is geared to the locator's tracking mechanism. When the corrector operator has centered the image of a ball, which is on the end of the pantograph, between cross marks on a mirror, he has automatically applied corrections for sound lag, wind error, target speed, and parallax error created by the distance (ideally about 1,000 feet) between the sound locator and the searchlight.

Just below the pantograph is another tiny device, known as a course indicator. This is in the shape of a miniature airplane and is coördinated with the movement of the horns to indicate the direction in which the target is flying.

While the sound locator is an efficient instrument, the great speed of modern aircraft makes its range too limited to be completely satisfactory. The Army, therefore, is developing a new and secret device about which no detailed information can be given. This is a radio direction indicator, based on the principle of similar devices now being used by the British which are said to be able to pick up an enemy plane before it leaves the French coast and track

it across the English Channel. The range of this radio locator is part of the Army's secret, but it extends perhaps up to 100 miles.

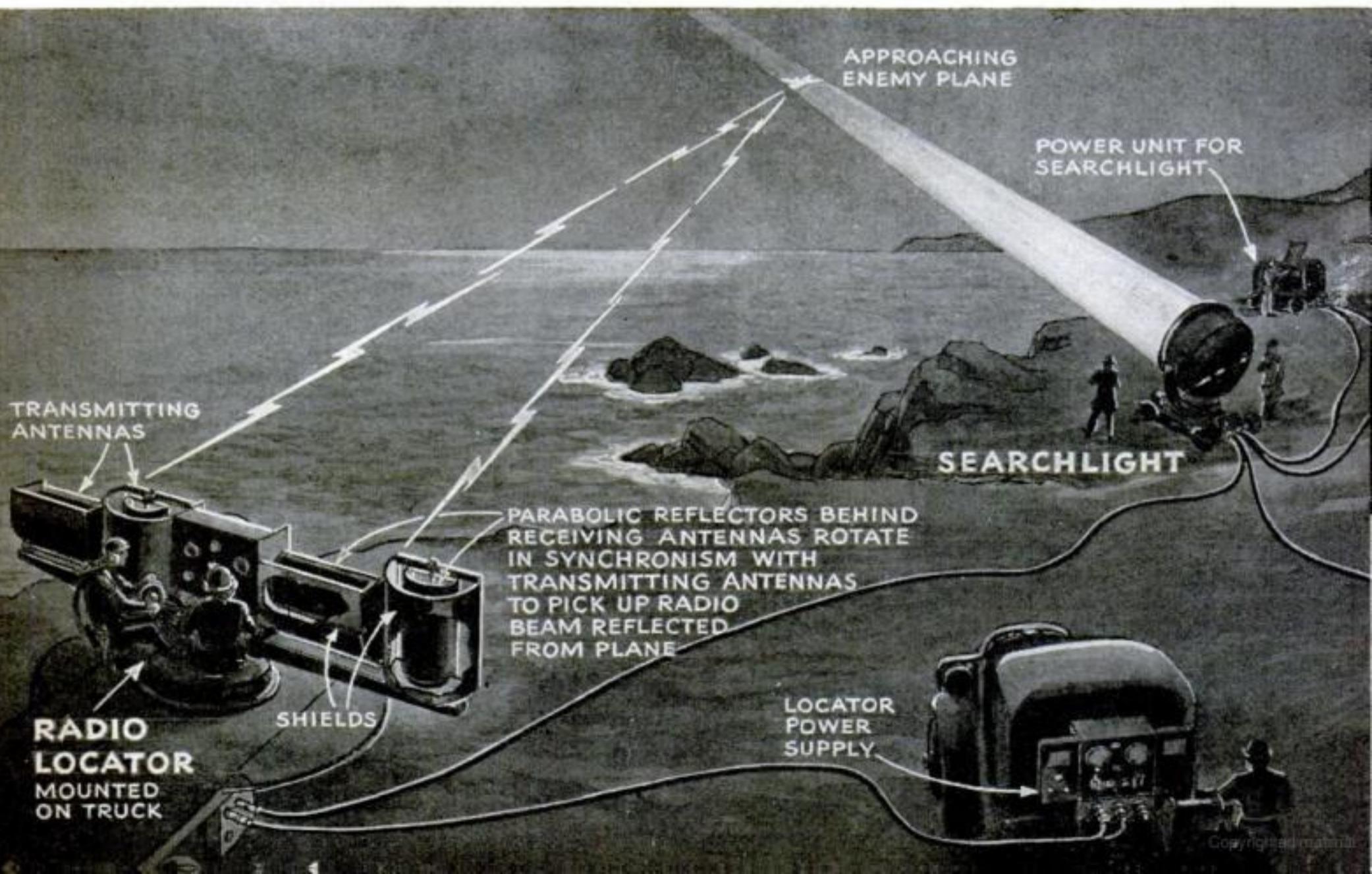
Cables from the binaural sound locator described above lead to the searchlight and thence to an apparatus called the control station, which is operated by three men. The control station, by which the light is moved electrically, is situated at least 50 feet and perhaps as much as 600 feet away from the light. This enables observers to see more clearly, just as a man will hold a lantern away from him in order to avoid being blinded by its rays.

The corrected data flow from the sound locator to the control station where there are an azimuth tracker and an elevation tracker. Here handwheels are turned until the azimuth and elevation dials correspond to the information that is constantly coming in from the locator. The light moves correspondingly as the wheels are turned and at the moment when the plane is believed to be within range the light is turned on.

The antiaircraft searchlights send out a beam of 800 million candlepower intensity produced by a carbon arc burning in a crater, the light being reflected by means of a parabolic metal mirror. The beam has a range of from 5,000 to 12,000 yards, depending on atmospheric conditions. The light may be operated manually, but usually is controlled from the control station.

One other piece of apparatus is necessary

In a tridimensional radio-locator system recently patented, radio waves reflected from the body of a plane reveal its location. This is not U. S. Army equipment



to complete the set-up of one searchlight unit. This is the mobile power plant, which consists of an air and water-cooled gasoline engine driving an electric generator that delivers about 150 amperes and 78 volts to the searchlight. The power plant is placed, if possible, with a knoll or some other obstruction between it and the other apparatus to eliminate its sound.

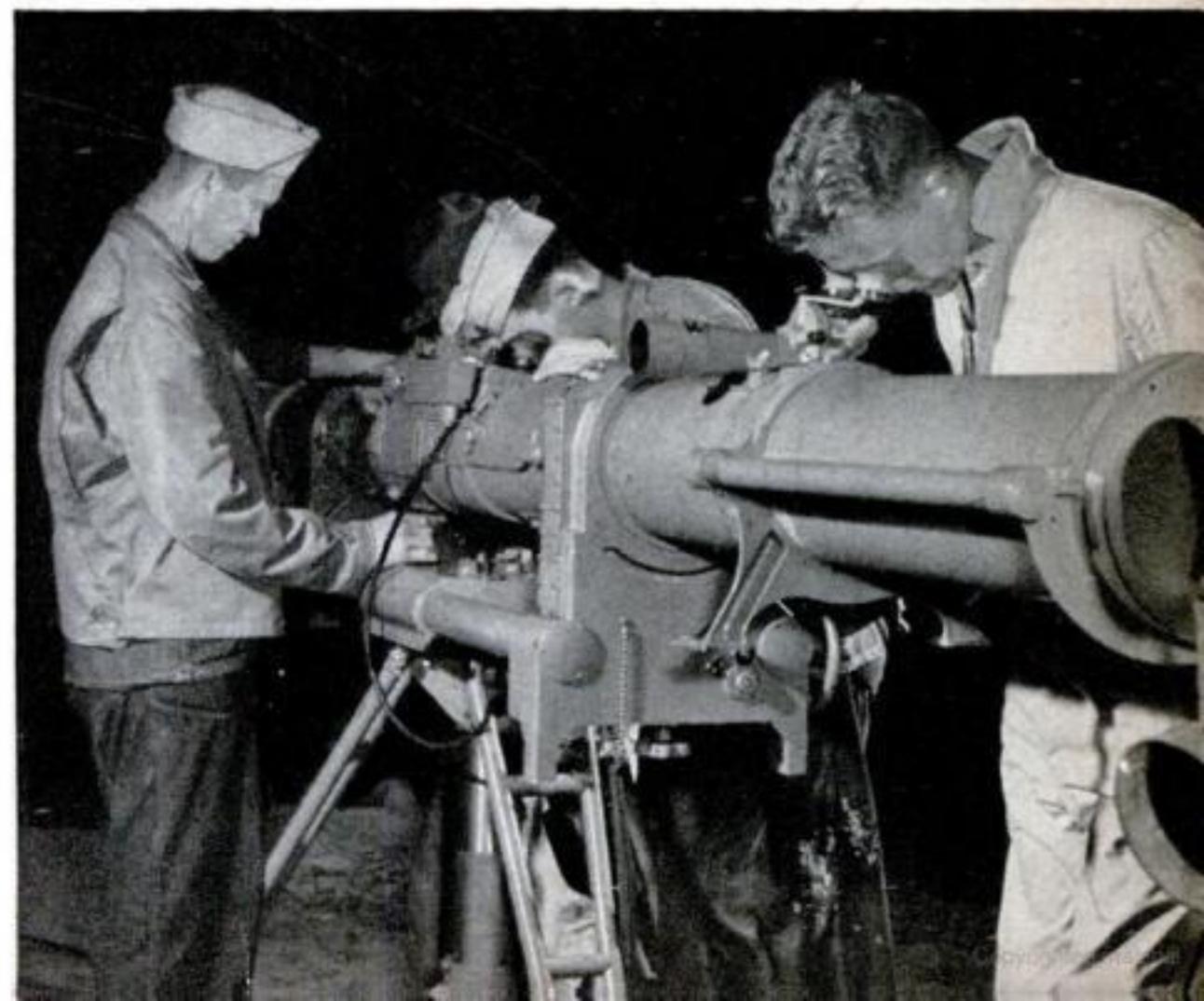
Once the lights get on a target the anti aircraft-gun battery goes into action. Contrary to popular impression, there is no close association between a searchlight battery and a gun battery. The two work separately, each with its own instruments. When a target is illuminated, the crew of the gun battery track it by means of a stereoscopic height finder and director, by which azimuth and elevation readings are obtained. Firing data are electrically transmitted to the guns and set by members of the crew by turning hand wheels. The fuse of the shell is cut to explode at the desired height, and the projectile streaks skyward.

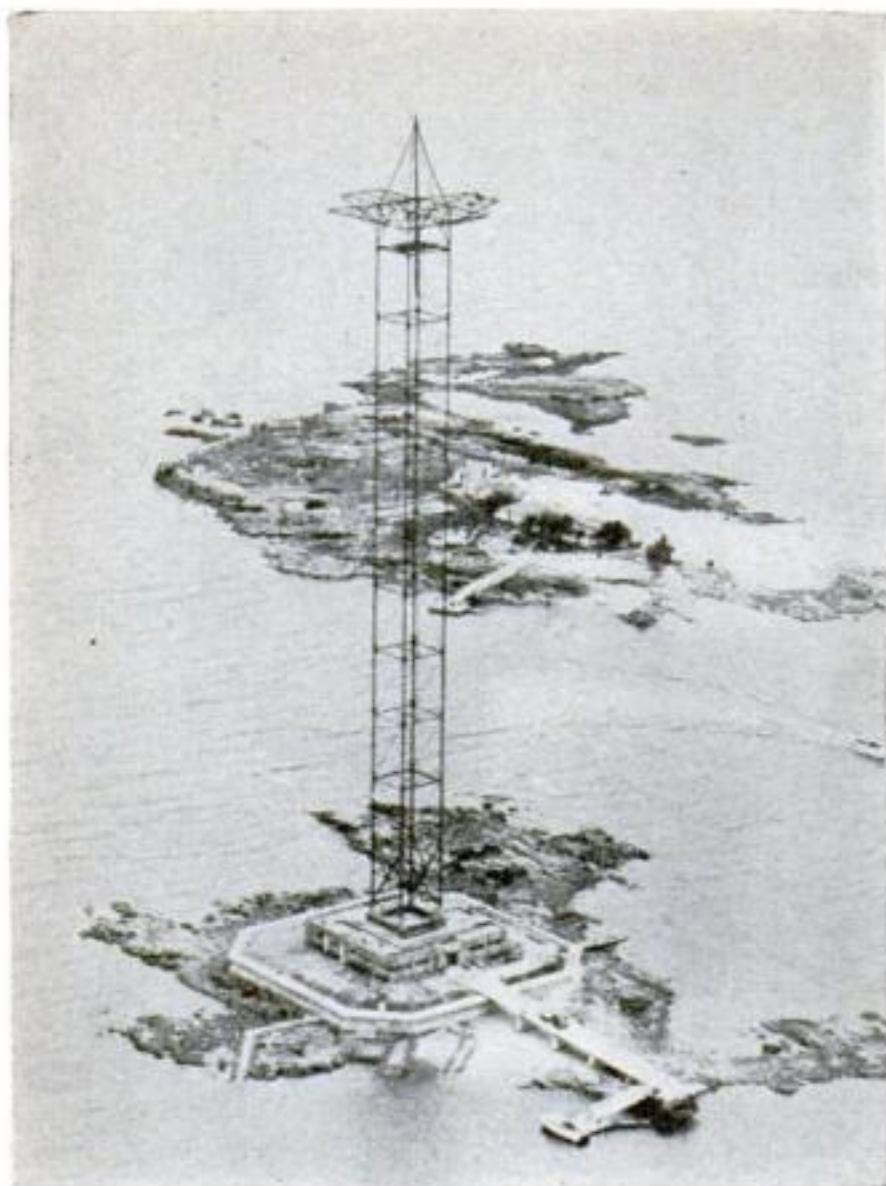
So ends a practice night with the Army's watchdogs, as they practice their job of guarding our night skies.



A GUN SWINGS INTO ACTION. Locators and searchlights have only one purpose—to give the batteries something to shoot at. The three-inch plane smasher above can heave its projectile to a height of 9,000 yards at a target illuminated by the big lamp

GETTING THE RANGE. Aiming the guns is an entirely separate operation from training the searchlights. The men below are using a stereoscopic height finder. Their readings go by cable to the director, which adds the direction and speed of the plane



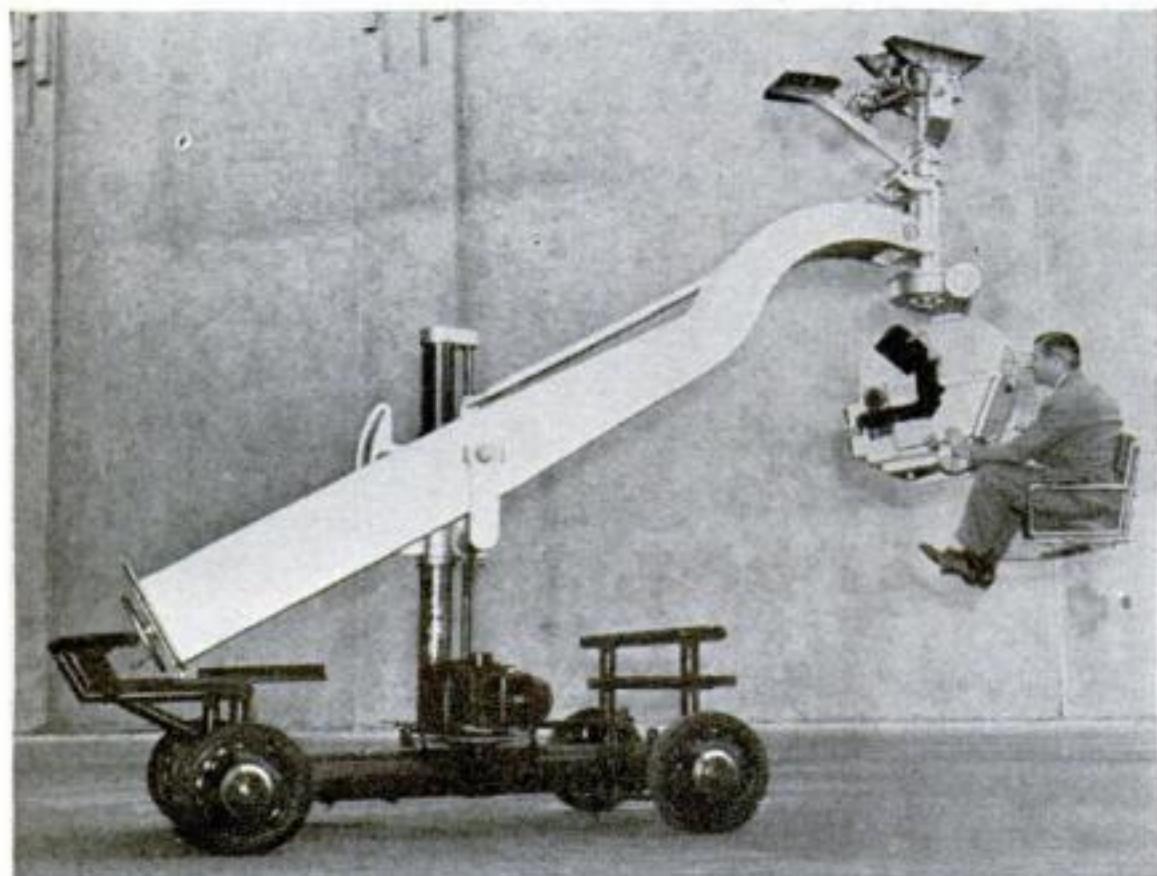


## Powerful Radio Station Housed on Tiny 150-Foot Island

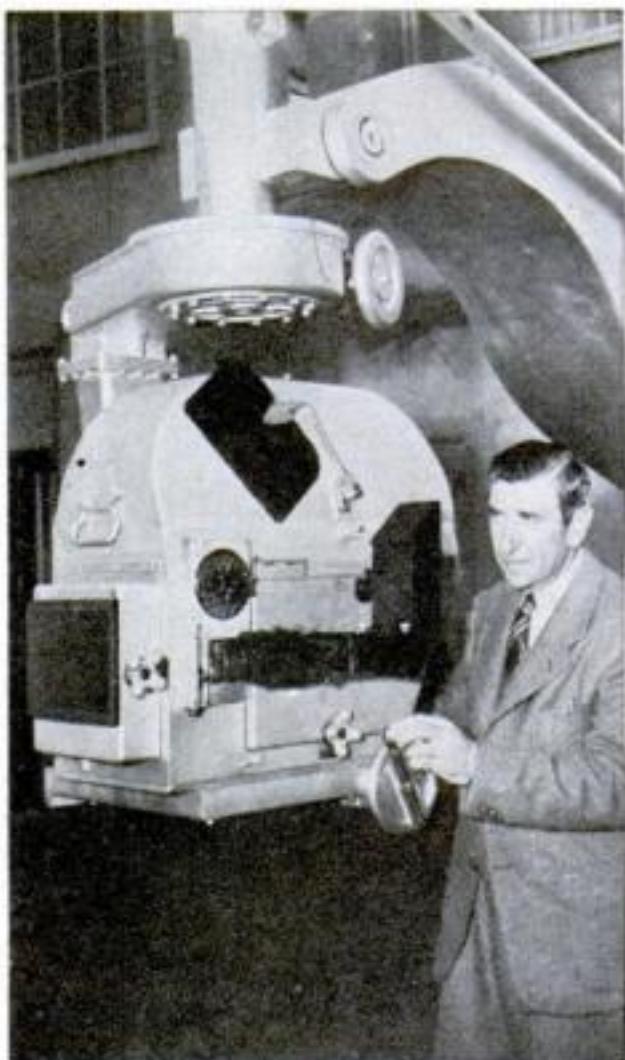
ON AN ISLAND in Long Island Sound, a mile off New Rochelle, N. Y., and only 150 feet square, is the new transmitter of WABC, 50,000-watt station of the Columbia Broadcasting System serving an audience of 14,000,000. It is topped by a 410-foot antenna tower on four concrete pillars, each a yard in diameter, which rest on bedrock and rise through the transmitter building without touching it. Salt water surrounding the station gives excellent transmission.

A fleet of scows, lighters, tugs, launches, and rowboats carried more than 32,000,000 pounds of material to build the station. Three hundred tons of steel for the tower was transported in sections on barges. Four miles of cable, weighing 75 tons, link the station to shore. Current at 4,000 volts can be switched immediately from one cable to another should the first fail. If all power from land should be cut off, a gasoline-driven generator can be put into service in 15 seconds.

## Novel Movie-Camera Boom Takes Long Shots and Close-ups



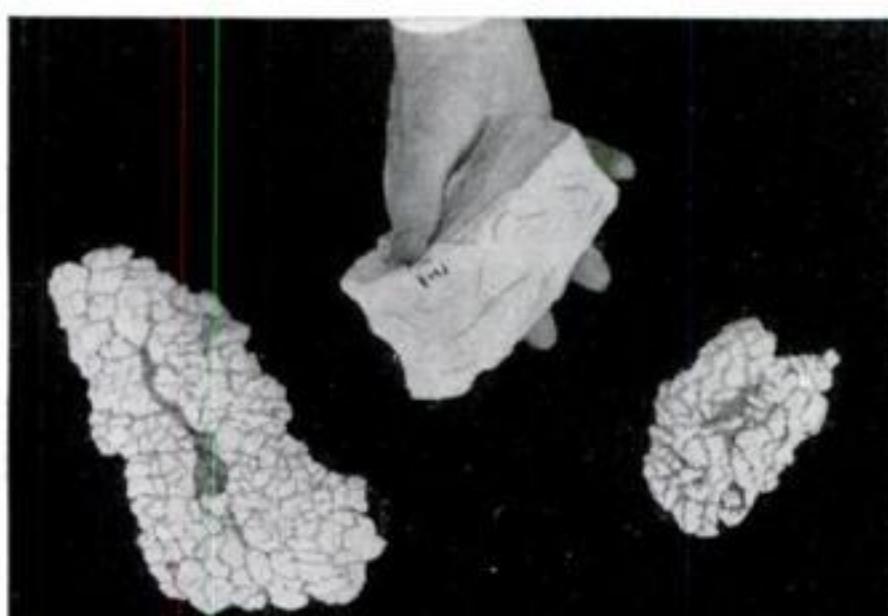
John Arnold, Metro-Goldwyn-Mayer camera chief, at left shows how his novel camera boom works. Below, he operates its quick-action panning device. Note underslung mounting, periscope finder



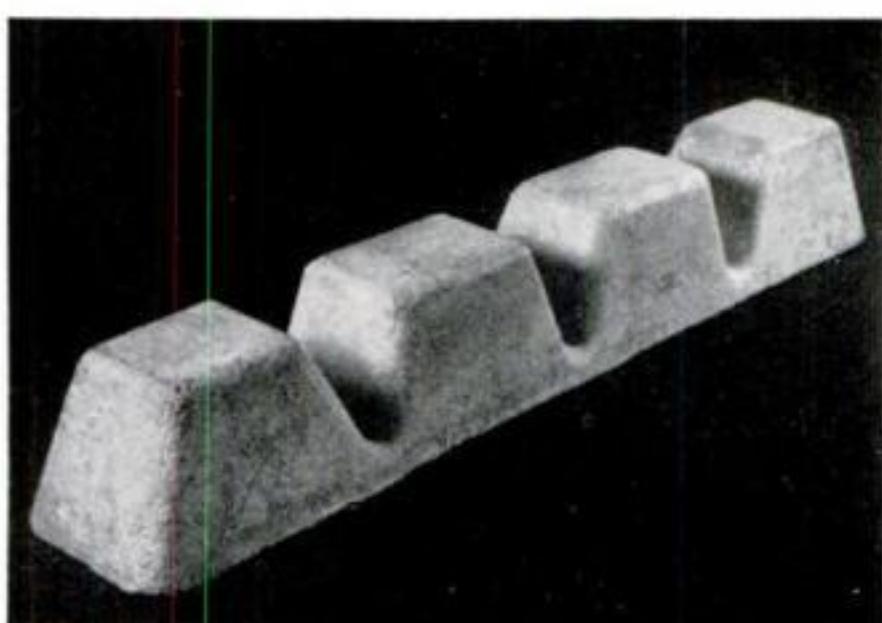
A NINE-FOOT motion-picture camera boom which makes it possible to "truck in" from aerial long shots to extreme close-ups has been designed by John Arnold, camera chief at the Metro-Goldwyn-Mayer studios at Culver City, Calif. A camera on top of the outer end can be raised 16 feet above the stage; one beneath it can be laid on the floor. The boom is raised and lowered by a motor-driven helical hoist, can be rotated through a full vertical circle and turned in its own length. It is valuable in filming such scenes as a long shot of a car moving in to a close-up of its speedometer.



Workers at the Wright foundry, Fairlawn, N. J., pouring molten magnesium to cast an engine part



**SOURCE AND PRODUCT.** Above are specimens of magnesite, a magnesium-bearing mineral, from (left to right) Cuba, California, and New Jersey. Below, an ingot of magnesium ready for the foundry. About two feet long, this chunk weighs only 21 pounds!



## LIGHTWEIGHT CHAMPION OF THE METALS

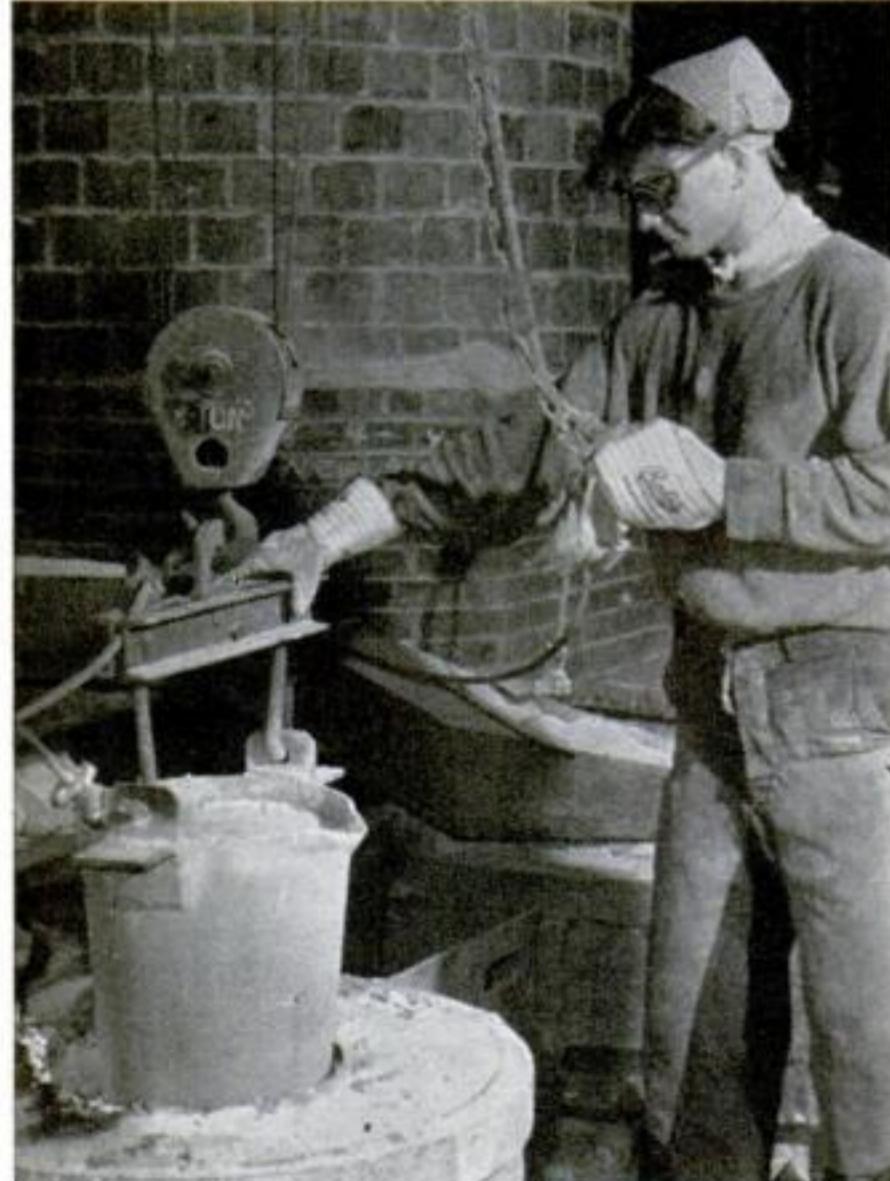
**Magnesium Saves Pounds in Plane Engines, Making Lift for Men, Guns, Fuel**

By ALDEN P. ARMAGNAC

THE YEAR before Hitler marched his troops into the Rhineland, the United States produced only 2,000 tons of a metal called magnesium. War came, and our 1939 output reached 3,000 tons. The fall of France spurred U. S. preparedness and boosted the 1940 figure to 6,000 tons. For magnesium, lightest of structural metals, was finding new places in warplanes to defend America. And now our giant aircraft program makes these figures seem picayune. Our output of urgently needed magnesium metal is expected to reach a yearly total of 15,000 tons for 1941, 45,000



**FLUX TAMES FIERY METAL.** Throughout the foundry process, molten magnesium must be kept covered with an oxygen-excluding film to prevent it from spontaneously bursting into flame. This is done by continually sprinkling on it a flux of sulphur and boric acid. Above, a worker adds the flux to magnesium as it goes into a crucible



A one-ton monorail hoist smoothly lifts the boiler-steel crucible of molten magnesium so a ring bar can be slipped under it for carrying to the mold

tons in 1942, and perhaps more than 60,000 tons ultimately.

For extracting it from the mineral known as magnesite, at three big plants to be erected in Nevada, the Government has just awarded a \$63,000,000 contract to Basic Magnesium, Inc. Production of the silvery, featherweight metal from the same source recently began in the first unit of the Permanente Corporation's \$9,250,000 establishment near San Jose, Calif. And the Dow Chemical Company, which has been obtaining magnesium from brine wells at Midland, Mich., has just opened a great \$5,000,000 plant at Freeport, Texas, for recovering magnesium from sea water!

Figures again speak louder than words to explain the sensational magnesium boom. Aviation gets the lion's share, 75 percent, of the principal kind of magnesium marketed—a structural alloy containing a scant amount of other metal, such as aluminum. A typical pre-alloyed ingot like the one pictured on the preceding page measures about two feet long. Lift it and you will get the surprise of your life, for it weighs only 21 pounds. It would take two men to carry a cast-iron ingot of equal size. Notches in the solid metal enable a foundry worker to break off a desired quantity with a sledge, and add it to a melting crucible.

Makers of airplane engines and propellers consume 64 percent of aviation's high-purity magnesium; airplane-wheel manufacturers, 19 percent; and airframe makers, 17 percent, according to a Government report just off the press.

Wright Aeronautical Company engineers estimate that 91 pounds of weight is being saved in each 14-cylinder, 1,700-horsepower motor by substituting magnesium for aluminum in nose covers, supercharger housings, and smaller fittings. On a four-engine bomber, this amounts to an increase in "pay load" of a barrelful of gasoline, or nearly the equivalent of two extra crew members.

Magnesium-alloy wheels for large land planes have proved so satisfactory that more than three fourths of the aircraft under construction are being equipped with them. Parts of aircraft frames employ the metal, and experiments are under way with a plastic fuselage molded over magnesium reinforcements. Full-size wing panels of magnesium are being tested. Aluminum-base alloys continue to make up by far the major structural weight of a plane, but even these contain a small proportion of magnesium, which is a third lighter than aluminum.

Nearest competitor to aviation, the automotive industry uses only ten percent of high-magnesium structural alloy, in parts of automobile and tractor bodies, starters, and

generators. Next come makers of portable appliances such as typewriters, sewing machines, vacuum cleaners, drills, and polishing tools, which account in all for about six percent; the rest is scattered among a diversity of industries.

Besides extreme light weight, there lurks within magnesium another terrible but useful property—the dazzling inferno of flame

with which it burns when in powdered or molten form. A reasonably thick piece of solid magnesium will not ignite, as a lecturer once demonstrated before the Electrochemical Society by smoking a pipe fashioned from the metal. But veteran photographers well remember the blinding light of burning magnesium in flashlight powder and ribbon form. Today it serves in many kinds of mu-

## How and Where Magnesium Cuts Weight of Airplane Engines



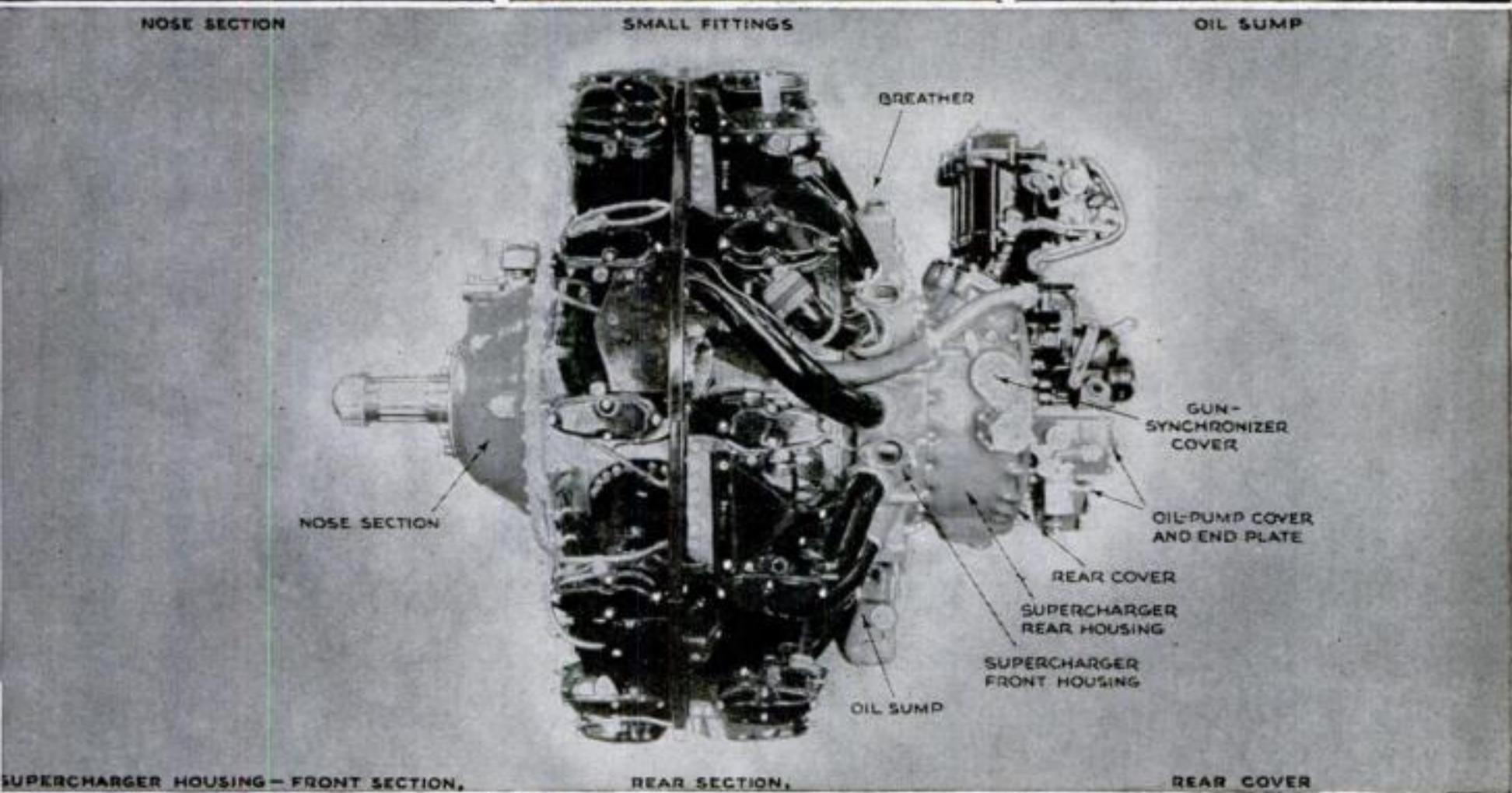
NOSE SECTION



SMALL FITTINGS



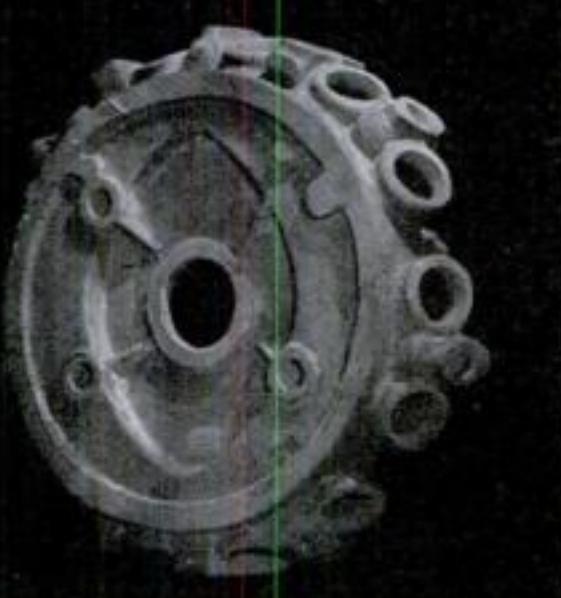
OIL SUMP



SUPERCHARGER HOUSING - FRONT SECTION.

REAR SECTION.

REAR COVER

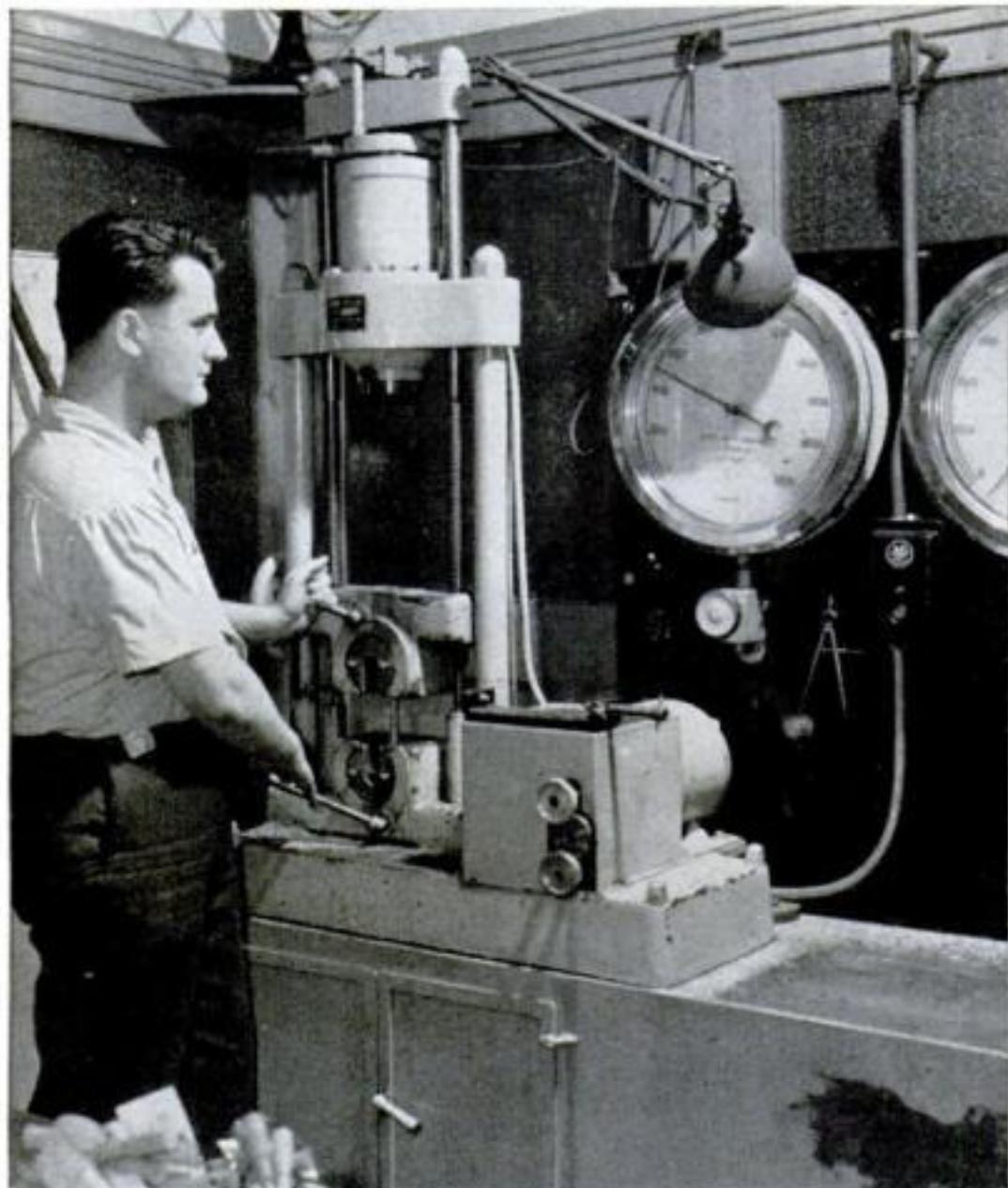


nitions such as tracer bullets, flares, and star shells.

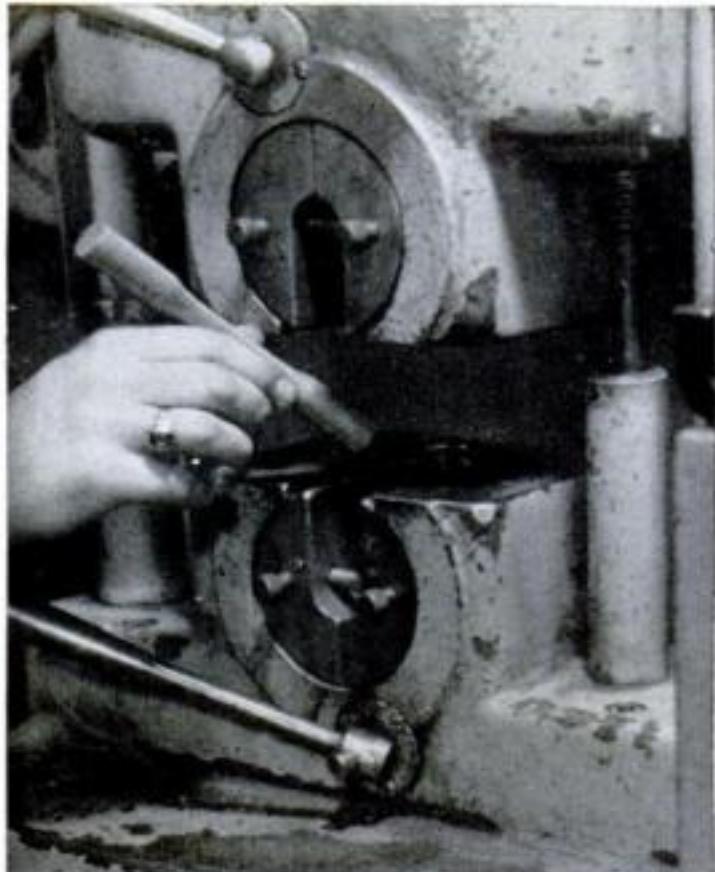
Heated above 1,200 degrees F., solid magnesium melts and spontaneously ignites on contact with air. The result is one of the most dangerous of incendiary bombs in use abroad. Missiles of this type weigh only about two pounds apiece, so that a single plane can carry 1,000 to 2,000 of them, and drop them on rooftops with little noise. An impact fuse ignites a filling of thermite, a fiercely burning compound sometimes used in welding. In turn, its heat melts and ignites the casing of the bomb, which is made of magnesium! Here is a weapon of almost 100-percent efficiency, starting two kinds of fires that water will not extinguish. The thermite burns at 3,000 degrees centigrade for about one minute, and the magnesium casing burns about 15 minutes. The best way to put out such a bomb is with sand.

But American industry has had to lick

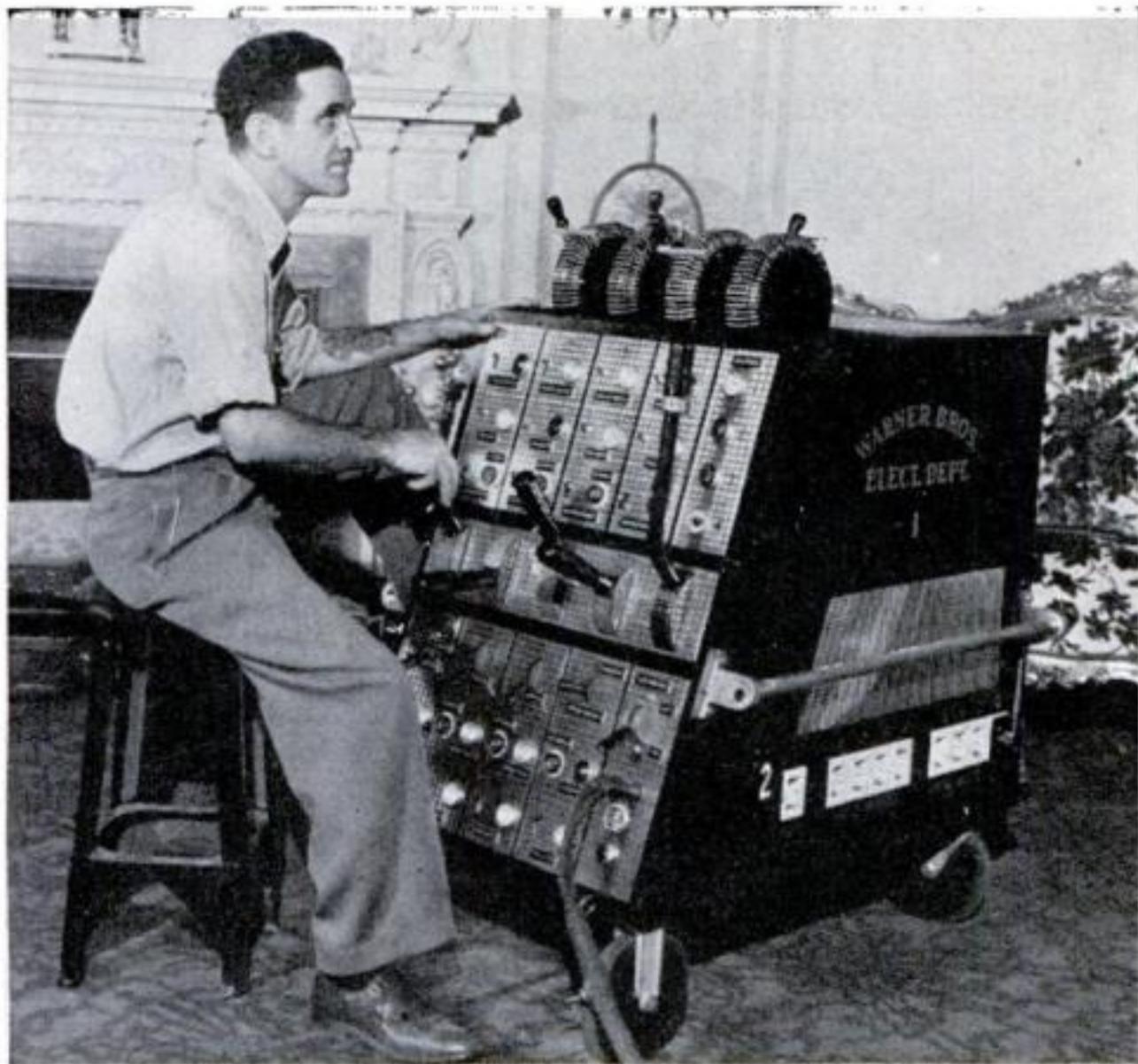
the same problem, in order to melt the Jekyll-Hyde metal and pour it safely into molds. The moment you enter the world's largest magnesium foundry at Fairlawn, N. J., which turns out ten tons of castings for Wright engines in a 24-hour day, an all-pervading odor of sulphur tells part of the secret. Here is a worker tending 100 pounds of molten, slag-covered magnesium in an oil-heated crucible, intent on dousing each bright spark that flashes up with a scoopful of "flux" containing sulphur, boric acid, and other chemicals. Another man, with a shaker such as bakers use to sprinkle doughnuts with powdered sugar, applies a sulphur-and-boric-acid flux when the crew of ladlemen direct the glowing stream of liquid metal into the sand mold for a casting. By forming a thin but effective oxygen-excluding film, the fluxes tame the fiery metal to which America and her warring friends look for air supremacy.



Before magnesium castings leave the foundry, correspondingly marked test samples go to the laboratory. In the machine above, they are stretched, compressed, and given other physical tests, while dials show the results. The photo at upper right shows a sample being placed in the jaws of the machine. At the right, a supercharger is being given the "bubble test." With outlets plugged, it is filled with compressed air and held under water. Escaping air betrays porous metal or cracks



## Switchboard Near Camera Controls Movie Lights



At the controls, the switchboard operator watches the action on the set

MOVIE electricians no longer need carry lights in and out to "balance the set," since the invention by I. M. Combs, chief electrical engineer at the Warner Brothers studio, Burbank, Calif., of a control switchboard which dims any one light, any group, or all at once. Placed near the camera, it permits the operator to watch the action. A master control dims through 110 steps to avoid flicker. Each control circuit is numbered, and when a lamp is plugged in, a tag with a corresponding number is hung on the lamp, so the operator can instantly follow an order by the cinematographer for the dimming of a given lamp or lamps in filming a scene.

## Gun Shoots Even Coating of Glue Regardless of Its Angle

GLUING wall boards to studs in housing construction is simplified by a gun which can spread two quarts of glue in an even one-inch line on 408 feet of studding. A doctor bar combined with a corrugated roll at the nose assures a uniform flow no matter how the gun is tipped or whether it is full or nearly empty. A saving of two thirds of the labor of brush gluing is claimed, plus the elimination of the usual wasting of glue.



Used in putting up prefabricated wall boards, this gun spreads its trail of liquid glue as evenly on studs as it does on a flat surface



Delegates to the Fifth Annual Work Simplification Conference at Lake Placid, N.Y., working out their individual solutions to factory problems in the laboratory at the Lake Placid Club. Each represents a company which has invested \$1,500 and six weeks of an employee's time to add efficiency to its operations

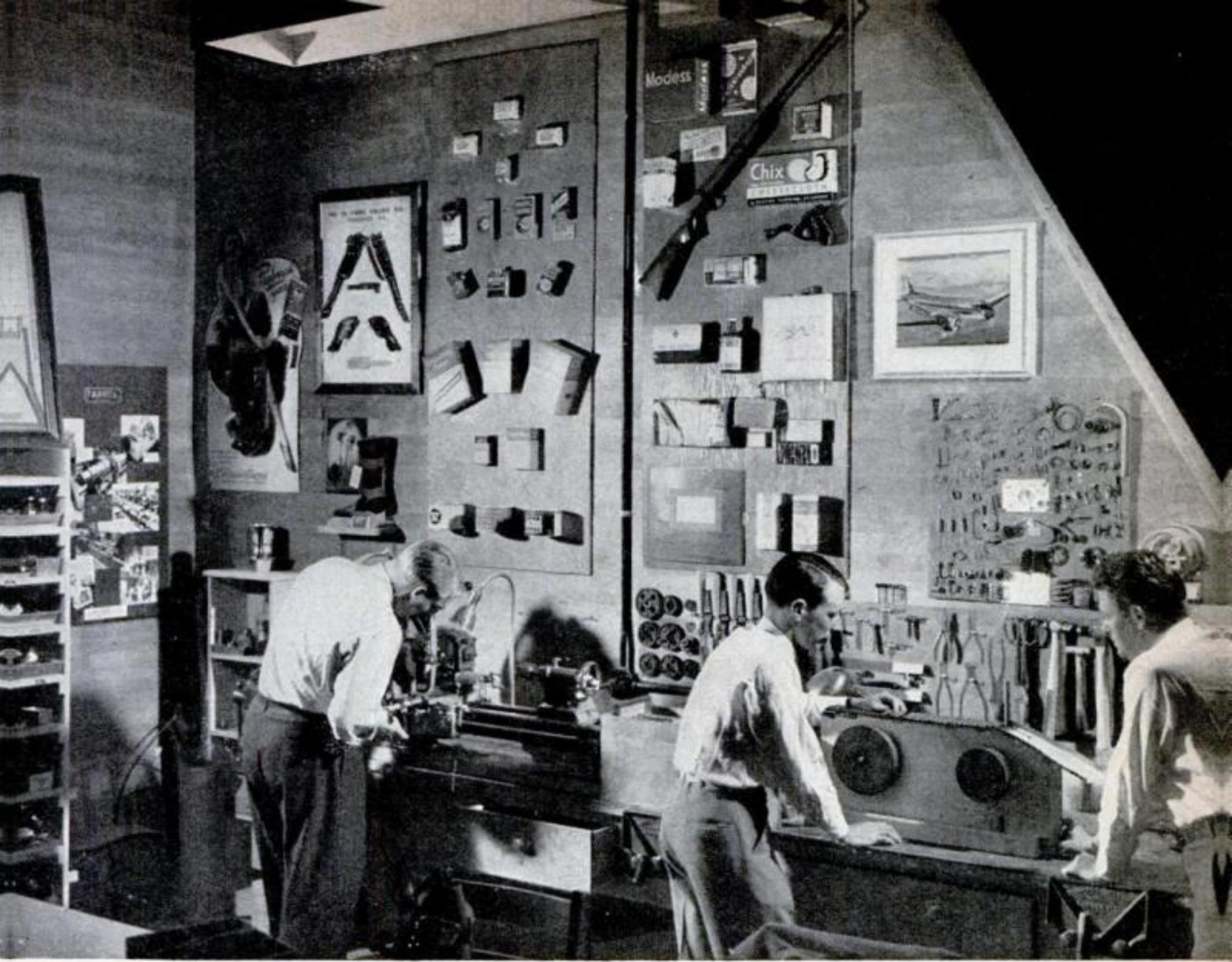
## Putting More Minutes

SPENDING time to save time is proving a profitable investment for American companies sending representatives to the annual Work Simplification Conference, at Lake Placid, N. Y. Each concern invests \$1,500 and six weeks of an employee's time. In return it gets the solution of a pressing manufacturing problem and ideas for stepping up production and cutting manufacturing costs through the elimination of waste minutes, motions, energy, and materials.

The conference, which completed its fifth year this summer, is headed by the noted industrial consultant, Allan H. Mogensen, of New York City. Among organizations benefiting from ideas obtained at

Dale Marks, from the Walter Baker Co., demonstrates the old method used in packing cartons with assorted chocolate bars





Three conferees at work on projects. The laboratory is equipped with a complete set of power tools for use in working out labor-saving devices. On the walls are products of various firms which have sent representatives to Lake Placid to study work simplification and apply it in their plants to save time and money

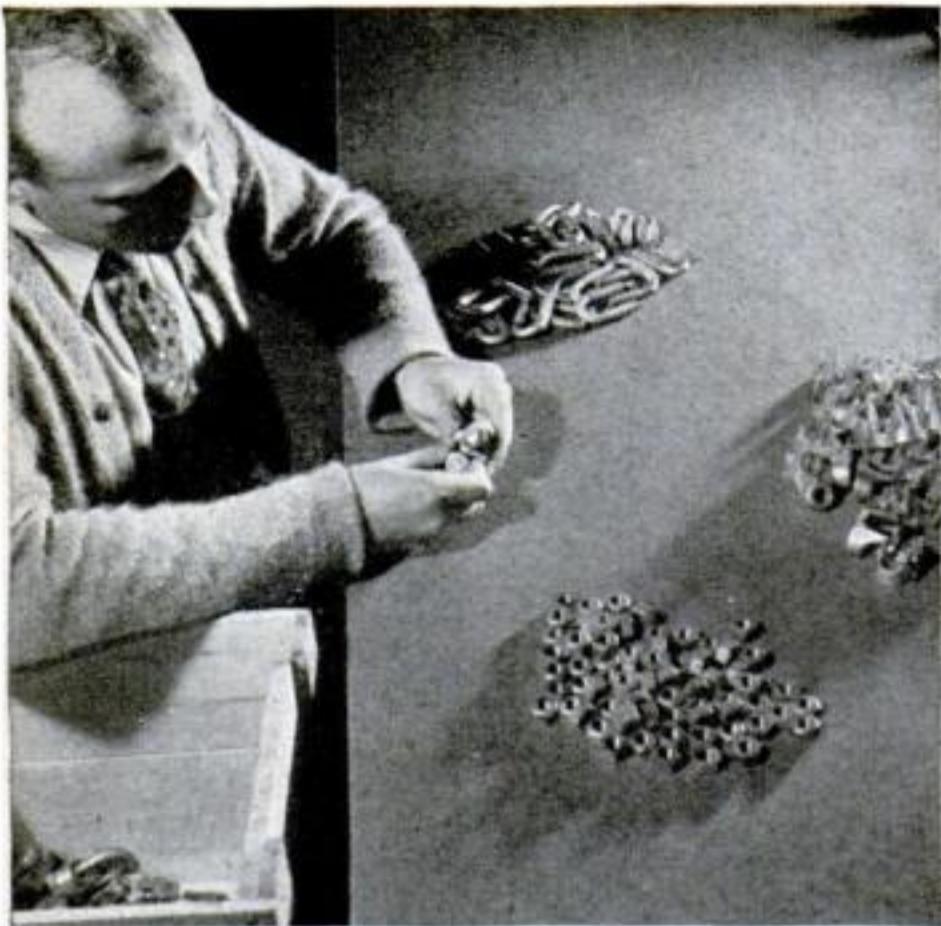
## Into Working Hours



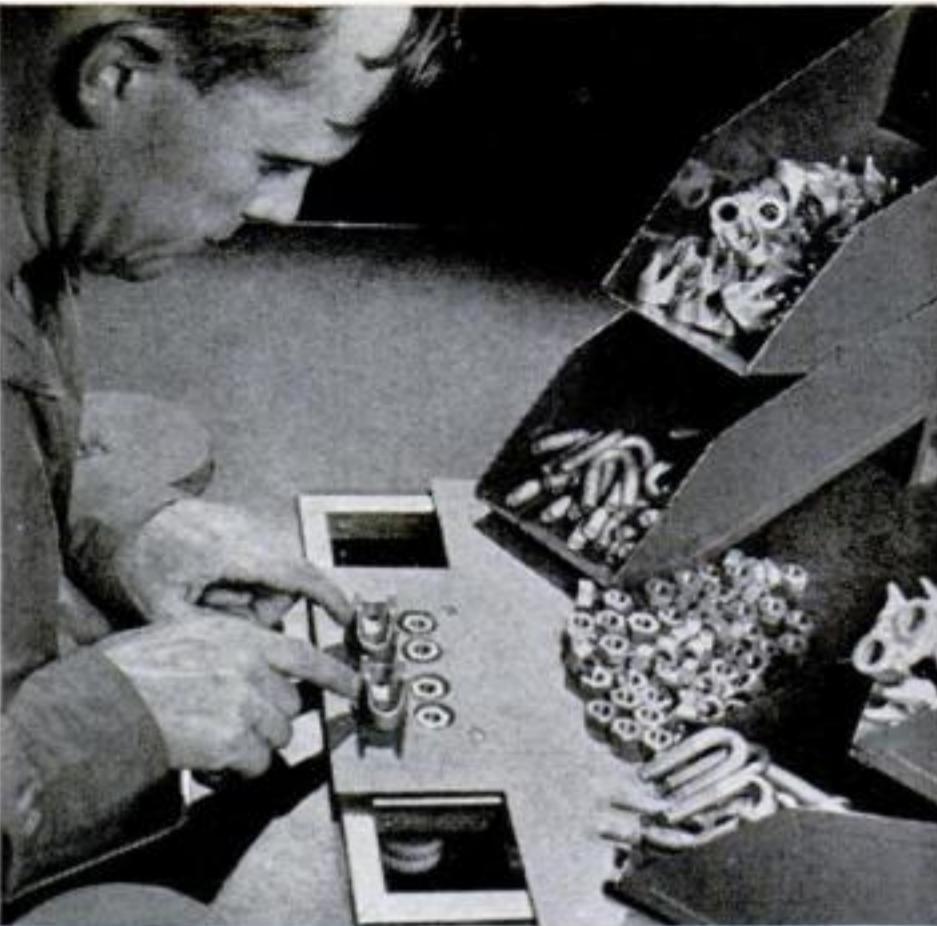
Lake Placid are such outstanding companies as Remington Arms, Republic Steel, Lockheed Aircraft, Bakelite, International Business Machines, Johns-Manville, E. I. du Pont de Nemours & Company, and United Air Lines. In an eastern factory producing gas masks, work simplification has already boosted production in one department 200 percent. At a surgical-appliance plant, minute-saving ideas have cut the cost of a first-aid item 32 percent and have boosted the sales 410 percent.

For the foremen and junior executives who attend the conference at the beautiful Lake Placid Club, the six weeks are anything but a vacation. Everybody is up at 7:30

This is the double-tier chute he worked out to speed the work. Feeding bars to a packer, it enables her to use both hands



At Republic Steel, cable clamps used to be assembled by hand in the haphazard manner illustrated above, and then thrown into a box at the side. A 50-percent increase in production is possible with a new method



. . . in which saddles are pushed over the nuts in a simple, fast operation. Hooks then go over saddles and assemblies are dropped in a hole. Note the handy bins provided to hold the parts

in the morning and work begins an hour later. After lectures and moving pictures that stress the fundamentals of work simplification, individual delegates tackle their specific problems. All the sessions are informal and the men often pitch in and help each other with their manufacturing headaches.

After lunch, the main scene of activity is the conference laboratory. Here, with the

aid of a complete set of hand and power tools, the delegates work out original gadgets that will speed up production in the manufacturing, assembly, or packaging departments of their respective factories. Apparatus invented in this room has meant a saving in hours and dollars in scores of American plants.

At last summer's conference, almost every one of the 25 delegates came with a



Allan H. Mogensen, head of the Conference, filming a project posed by Prof. David B. Porter of New York University. All completed projects must be filmed, with the old methods they replace, for reference use



Delegates learn how to handle movie projectors, in order to be able to show films at their home plants. Thus they can show workers how to follow the new methods, and the reasons for them

different problem. Many were seeking short cuts to greater production in vital defense industries. A glance at a few of the puzzles tackled and solved at Lake Placid will illustrate the practical nature of the meetings.

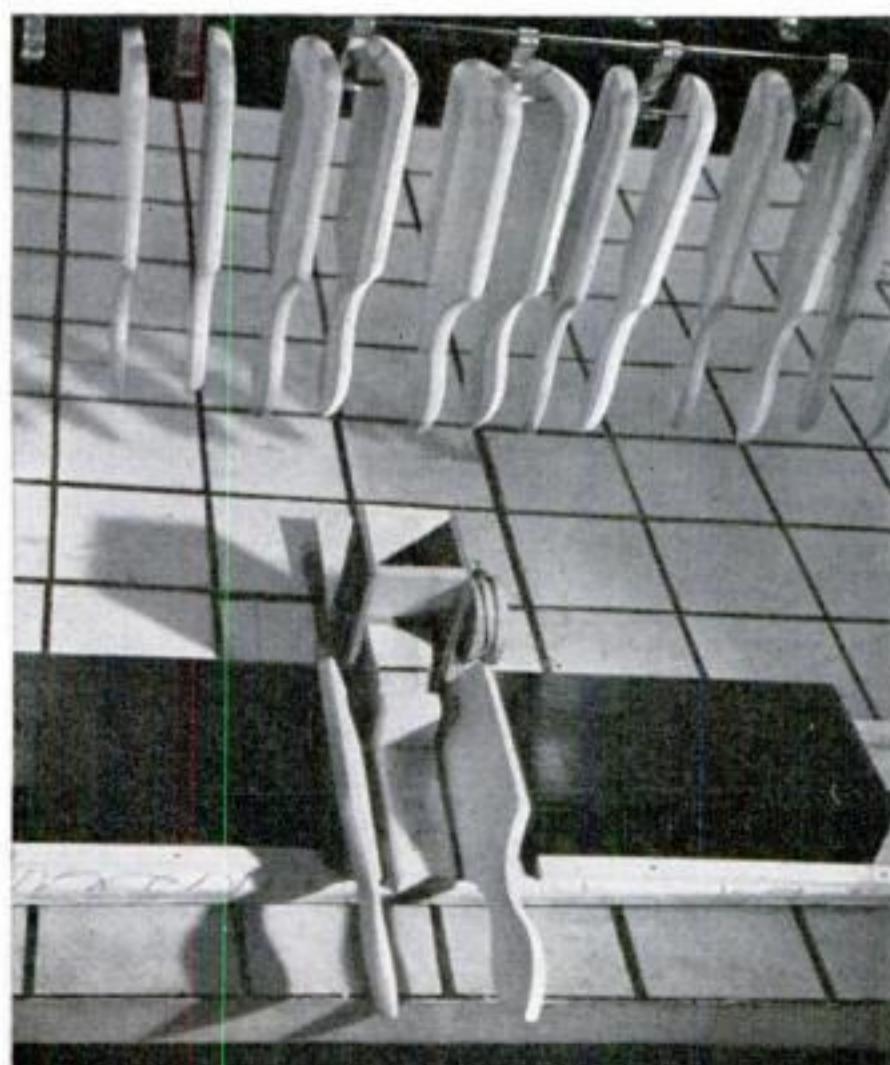
Vultee Aircraft, for example, wanted a simpler, quicker method of fabricating wire assemblies used on its military planes. Under the old method of manufacture, a worker cut the wires to the correct length, stripped the ends, put on the identifying

tapes, attached the lugs, and inserted the ends of the wires in the automatic terminal squeezer—the whole operation consuming five minutes. During his visit to Lake Placid, Joseph Druliner, the Vultee representative, worked out a simplified method of manufacture, employing a cutting meter and automatic stripper. It reduced the time of fabrication from five minutes to 48 seconds! That saving, multiplied an infinite number of times, will help get a greater number of fighting planes into the air in a



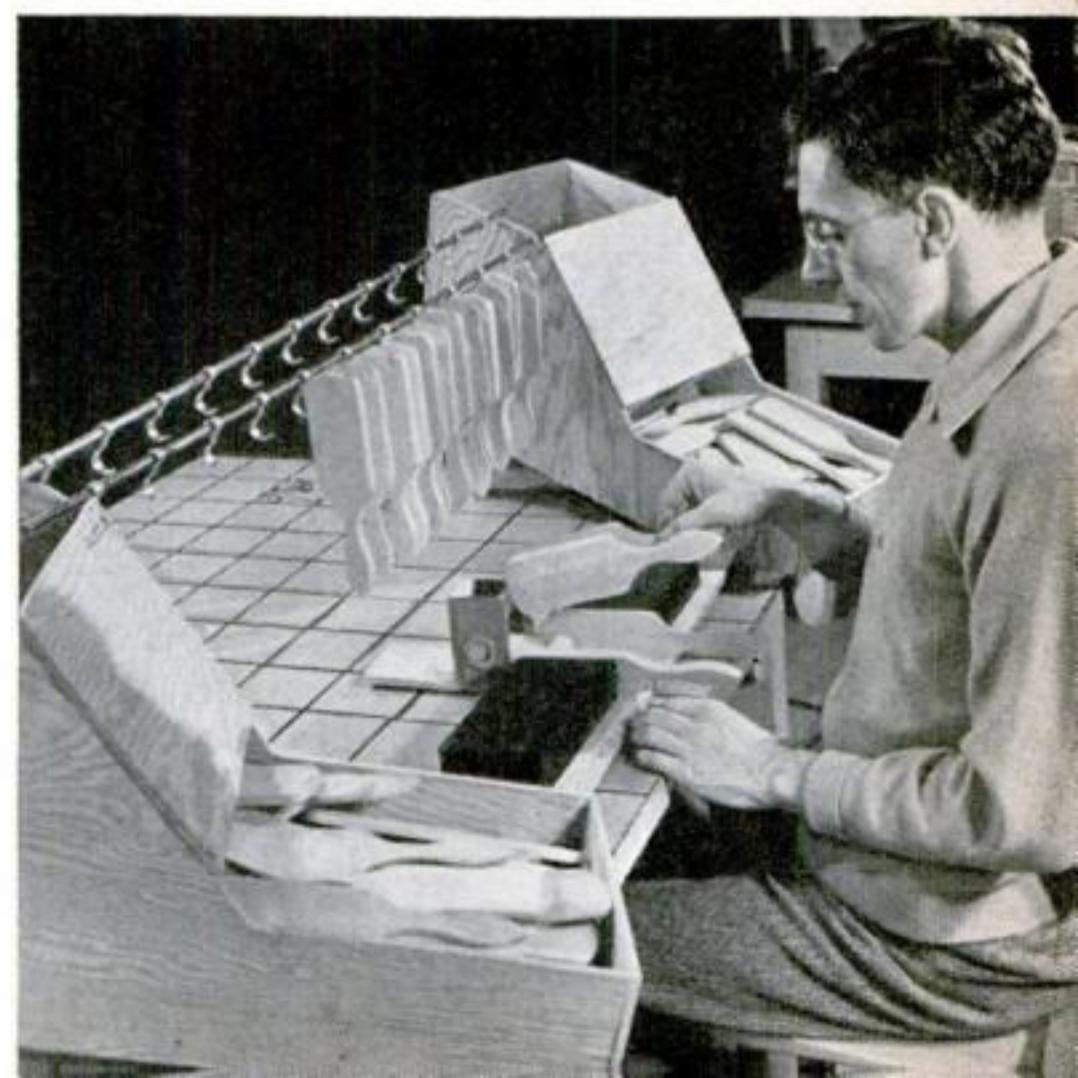
For dipping brush handles in lacquer, the Ox-Fibre Brush Co. used to have hooks laboriously driven in by hand. They sent George Hargis to Lake Placid

This feeds a double-pointed pin from the hopper below into a groove between the handles. A kick on the other pedal moves the black blocks together . . .



. . . where he developed this machine. Placing a pair of handles between two black blocks on the table, the operator of the device presses on a pedal

. . . driving one end of the pin into each handle. Springs pull the black blocks apart, the joined handles are hung on a hook, and new ones inserted



shorter time—a vital consideration today.

Republic Steel sent a man to the conference to find a better way of putting together cable clamps. He did. The new procedure he worked out will mean a 33-percent saving in the time required to complete the operation. This, in turn, will result in a 50-percent boost in production. While the man from Republic was achieving this advance, another delegate, representing Johns-Manville, was busy perfecting a simpler method for sorting iron washers, and a representative of the surgical supply house, Johnson & Johnson, was searching for—and finding—a time-saving improvement in

packing procedure that cut a product's cost.

A packaging problem also occupied the attention of the delegate from the Walter Baker chocolate company. By devising a double-tier supply chute, which delivers chocolate bars to the packers so they can use both hands without waste motion, this representative, Dale Marks, was able to step up the output of the packers 136 percent. Where five girls packed only 70 cases an hour, the new method enables three girls to pack 100 cases.

Frequently, substantial savings in time are chalked up without the introduction of any new apparatus at all. In one big east-

## PREPARING A LENGTH OF AVIATION IGNITION WIRE, BY THE



This is the method formerly used at the Vultee Aircraft plant in Nashville, Tenn., in fabricating wire assemblies for military planes. First, cutting the wire to measure took a full minute's time . . .



. . . then the insulation was stripped off the ends of the wire by hand with a pair of pliers, just as any householder would do in attaching a plug for an appliance. This consumed another minute



## NOW, THROUGH THE USE OF WORK-SIMPLIFICATION METHODS,



Vultee's Joseph M. Druliner demonstrates the improved method he worked out for doing the job. He draws the wire through a meter that cuts it to desired length



. . . and pulls it into an automatic stripper which removes the insulation from the ends. Work simplification has cut the time on these two jobs to 12 seconds



ern factory, where all machinery was supposed to be running at peak production, the output was stepped up 25 percent simply by eliminating waste motion through ideas obtained at Lake Placid.

Approximately five of the six weeks of the conference are consumed in completing all the individual projects brought for solution. As soon as a project is finished, it is filmed with a home-movie camera to provide a record and to aid in instructing workers back at the factory. Both the previous and the new methods are recorded so the person viewing the movie can see exactly how the change saves time and increases

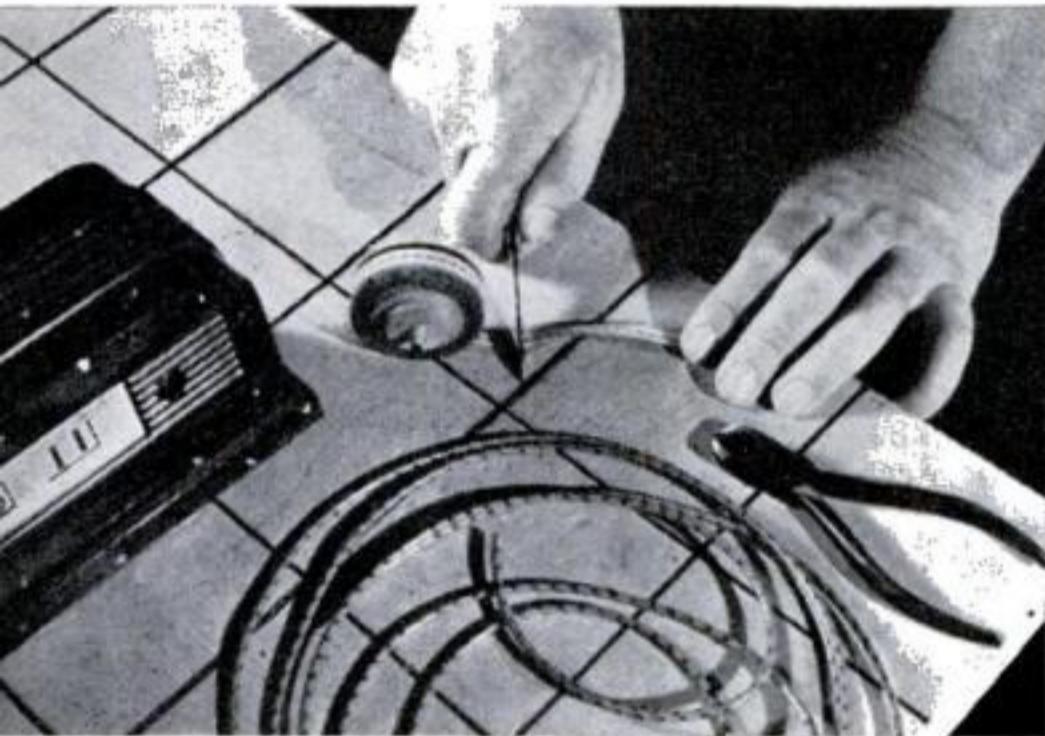
output. By demonstrating the reason for the change in this way, better coöperation is obtained at the plant where the innovation is introduced. More than 300 other movies, each showing some improvement in manufacturing technique, are also available for study by the delegates.

Scores of products, ranging from soap to firearms, have been hung on the walls of the conference laboratory. They are the unique trophies of a unique institution. Each is the product of a company that has obtained at one of the conferences ideas for saving time, cutting costs, and increasing production through work simplification.

## OLD METHODS, TOOK AN OPERATOR A TOTAL OF . . .



Identification tape of gummed cellulose was cut by hand and wrapped around the wire. Such marking is necessary because there may be 100 different lengths and sizes in one plane. Another minute



FINISH  
**5**  
MIN.

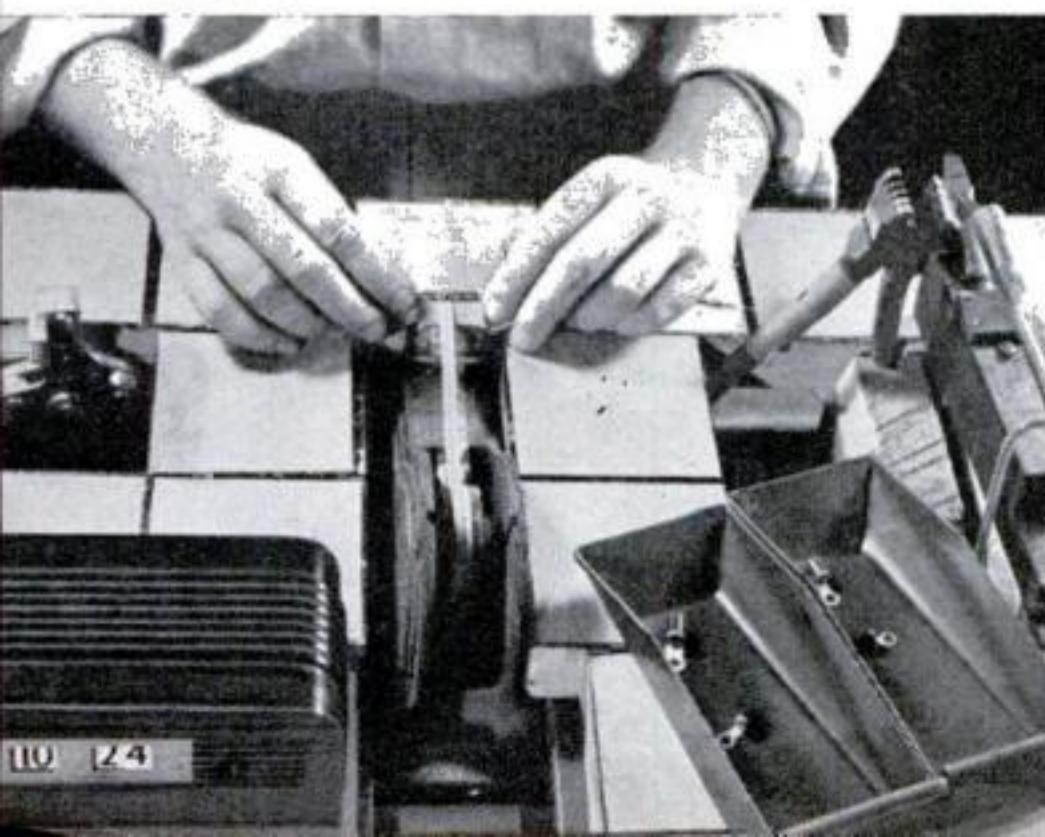
Twelve seconds more went into putting the stripped ends of the wire in the terminal lugs. Then the terminals were squeezed tight. Total time required, five minutes



## THE JOB TAKES THE SAME OPERATOR JUST . . . . .



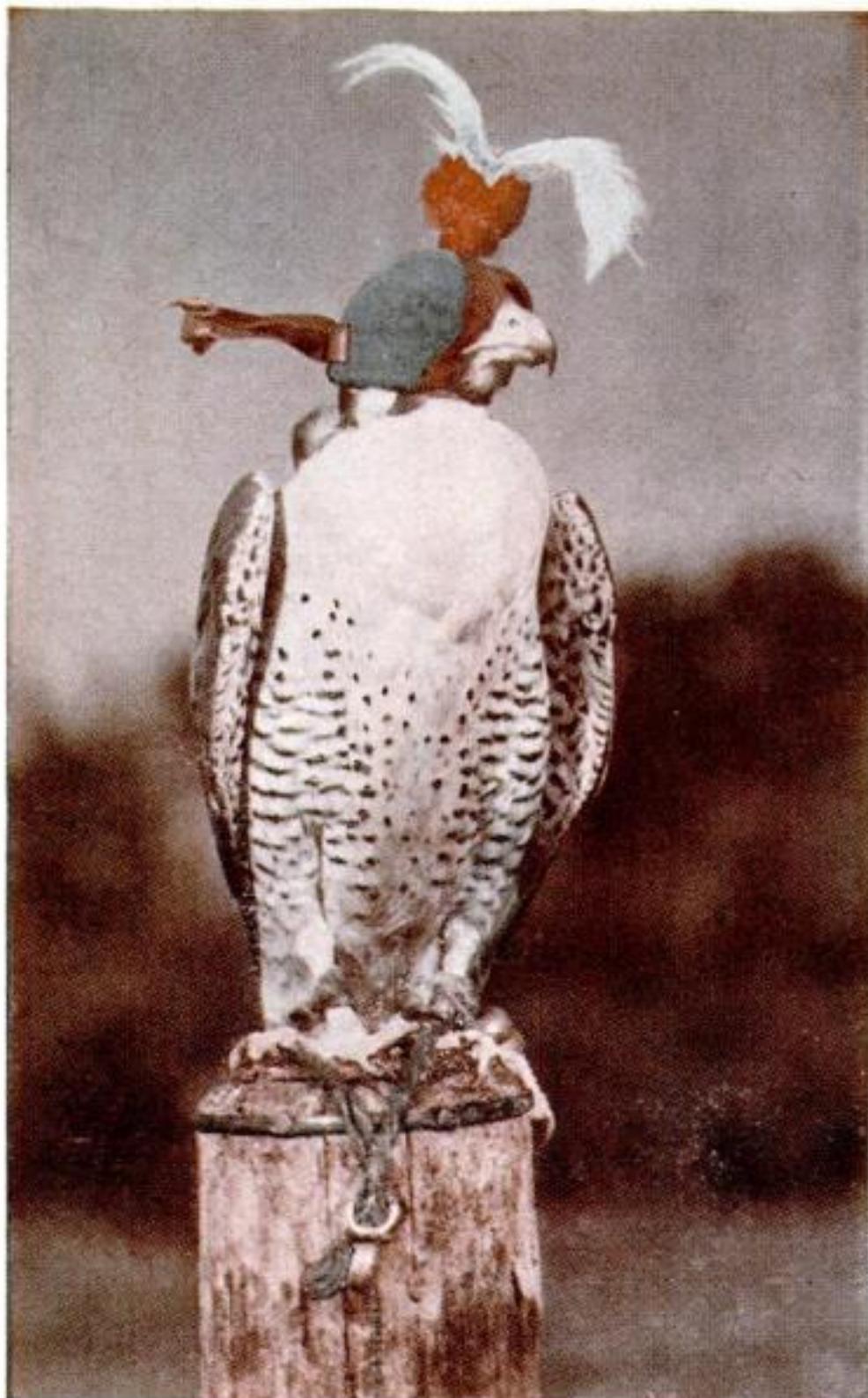
. . . and another 12 seconds goes into the task of cutting and winding the identification tape, which is done with a device that Druliner made for the purpose



FINISH  
**48**  
SEC.

Now the terminal lug is placed on the bare end of the wire and inserted in an automatic squeezer. Time required, 48 seconds





The American duck hawk—a true peregrine falcon—is one of the birds of prey being trained by sportsmen in the new revival of falconry. This bird shown sitting on the block used in "weathering"

HUNTING with hawks, a sport that flourished long before Marco Polo visited Kublai Khan, is now providing thrills for a growing number of Americans. In recent months, such organizations as the Smithsonian Institution, the American Museum of Natural History, and the U. S. Biological Survey, have received inquiries from all over the country on trapping and training falcons. More than 100 persons have joined the recently organized Falconers' Association of North America. By January, membership in this first nation-wide organization of its kind is expected to approach the 100 mark. Local falconry groups are now active all the way from New England to California.

Under the direction of Capt. Russell L. Meredith, of Boonton, N. J., and the editorship of Dr. Robert M. Stabler, of the University of Pennsylvania, the F. A. N. A. is publishing America's first national magazine

# Falcons— FEATHERED HUNTERS FOR MAN

**Sport of the Crusaders,  
Unchanged for Centuries,  
Lures Modern Americans**

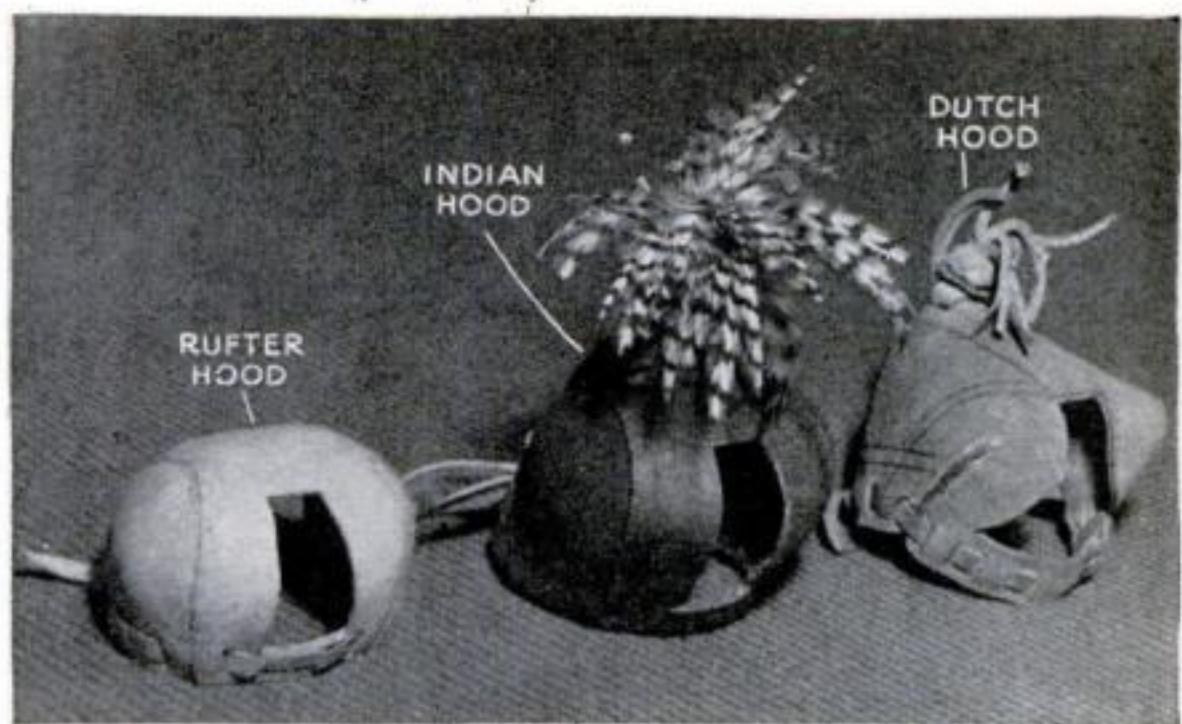
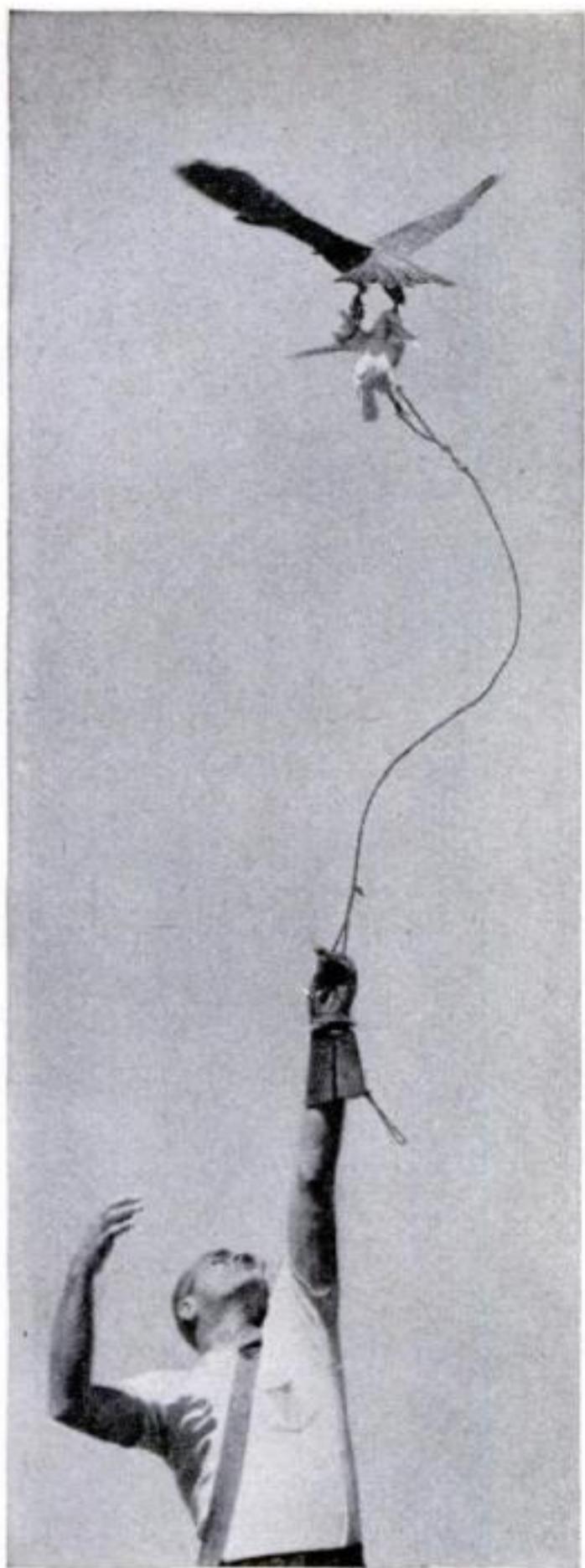
By EDWIN TEALE

on falconry. The initial issue of the publication, "The American Falconer," is just off the press. Each fall, the National Association will hold a tournament at which hawks from the U. S. and Canada will compete.

All over the world, hawks are divided into classes according to the shape of their wings. The short-winged hawks, such as the goshawk and Cooper's, pursue, overtake, and clutch their quarry. The long-winged hawks, including the peregrine falcon, the prairie falcon, and the gyrfalcon, plunge, or stoop, from a height and knock their prey to the ground with their iron-hard claws used as fists. A stooping peregrine is said to attain a speed of more than 200 miles an hour.

If a knight of the Round Table should visit our modern world, he undoubtedly would rub his eyes in amazement at the sight of tanks and planes and short-wave radios. But he would feel perfectly at home among America's growing band of falconers. For they are using the same methods, equipment, and picturesque language of the chase that have been handed down through the centuries.

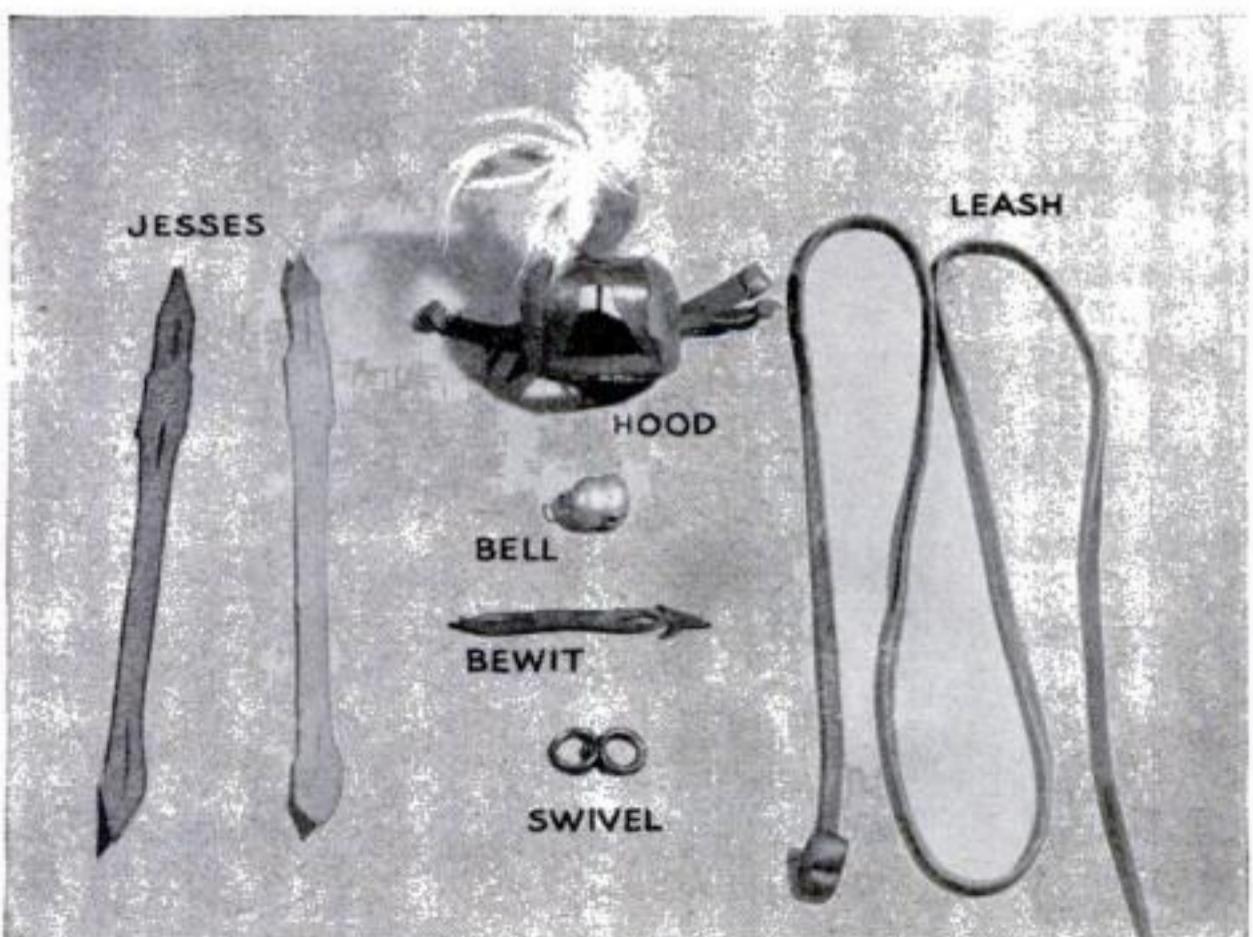
Just as falconers did in the court of Wil-



For centuries, these three types of hoods have been used to cover the eyes of hawks to keep them quiet when at rest. The unornamented rufter hood is the one used in training the birds to hunt

At left, Dr. Robert M. Stabler, a prominent American falconer, demonstrates with one of his own birds how a falcon stoops to the lure, which is swung around over the falconer's head

The drawing at the right shows a falconer with all his paraphernalia ready for service. Below is the gear of the ancient sport, almost unchanged since ancient times





*Cooper's Hawk*



*Prairie Falcon*



*Peregrine Falcon*



*Goshawk*

### FIVE KINDS OF FALCONS USED IN ANCIENT SPORT

Falcons are distinguished from other hawks by a notch in the upper mandible of the beak. Of the five kinds shown here, the Cooper's hawk and goshawk are short-winged hawks which clutch their prey in flight; these can work in cover. The prairie falcon, peregrine falcon (American duck hawk), and gyrfalcon are long-winged and knock their prey to the ground. The peregrine shown is an eyess, a bird taken from the nest, as distinguished from a passage bird caught full-grown.



*Gyrfalcon*

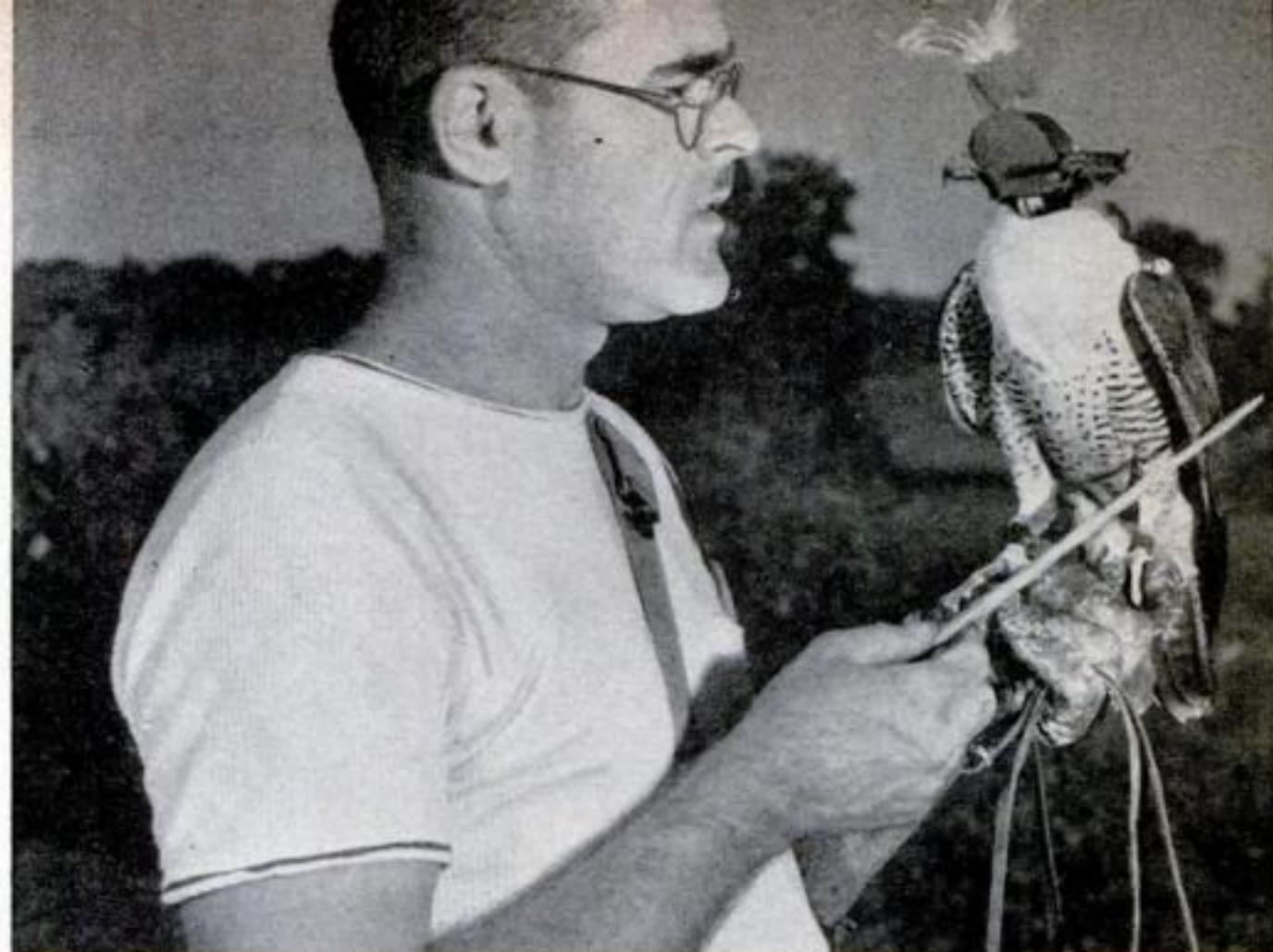
RINGING, or rising spirally from the falconer's fist, the hawk learns to wait on overhead until it sees the lure . . .

. . . to which a piece of beef-steak is attached. One type of lure is a horseshoe well padded and camouflaged with feathers

As the falconer swings the lure over his head, the hawk stoops to it. A well-trained hawk will speed to the lure from as far as it can see it



**STROKING.** During the early days of its training, the bird is kept hooded. As it is carried about on the gloved fist of the falconer, it is stroked frequently with the feathers of a dried pigeon wing or a wand as shown at the right. This calms the falcon's nerves and accustoms it to being handled. A low whistle or other sound is made by the falconer when the bird eats on the fist. Later, it will return to the glove whenever it hears the familiar signal



Putting on the hood with one hand while holding the hawk with the other takes practice

Pressing against the base of the longest drawstring with his index finger, the falconer pulls it tight

Now he pulls the other string with his teeth. To unstrike the hood, he just slips the strings



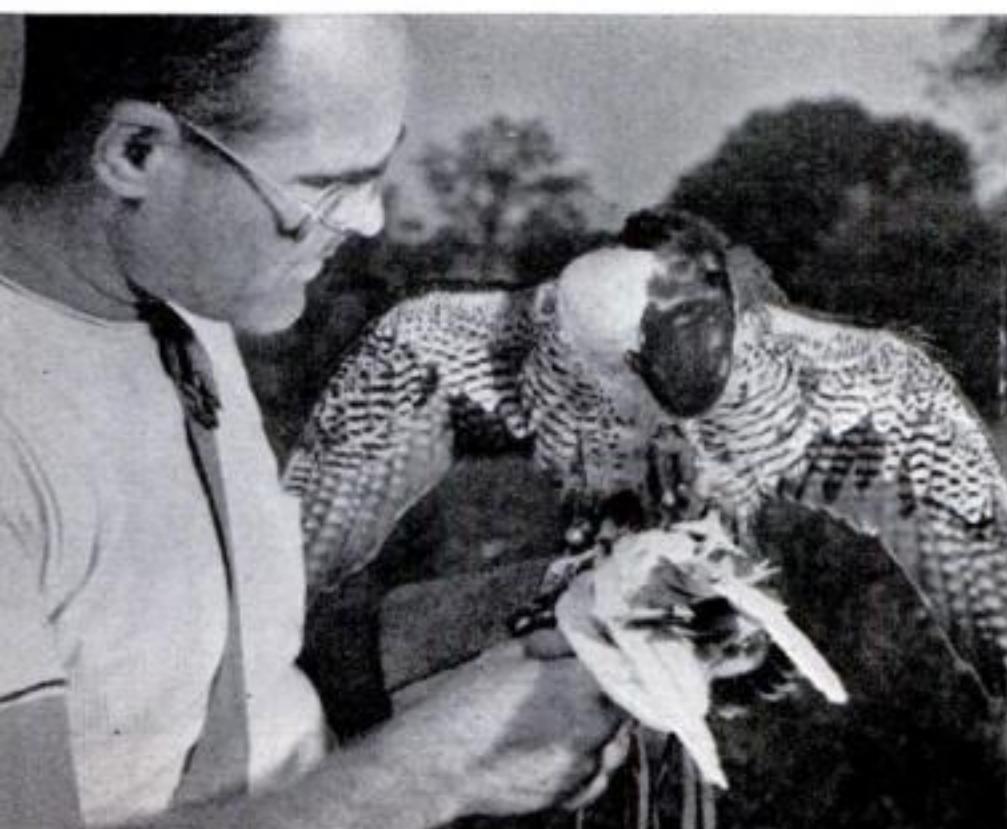
liam the Conqueror or Henry VIII, they secure the legs of their hawks with jesses—strips of leather which are, in turn, fastened by a swivel to a leather leash a yard or so long and ending in a button. Other straps

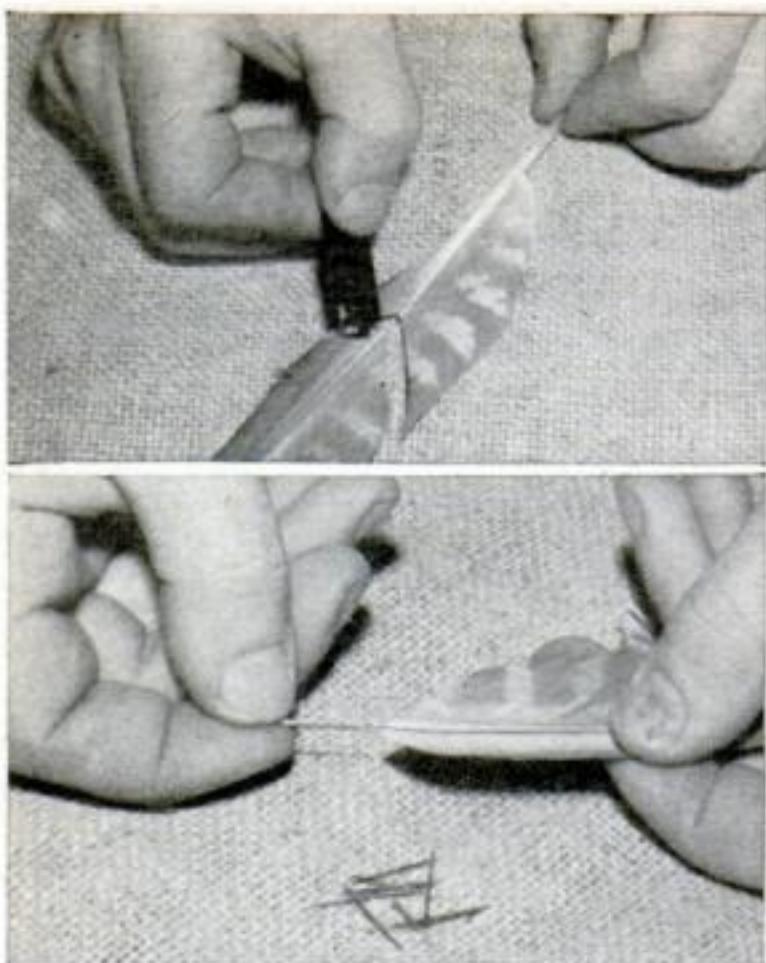
Feeding off the lure teaches the falcon to associate it with food. From time to time, birds are given tirlings, or plucked wings of pigeons, to keep the beaks in condition

of leather, called bewits, secure bells to the legs of the birds. Bells, bewits, and jesses remain permanently on the hawks. Sometimes, varvels, rings of silver on which the owner's name is engraved, have been added.

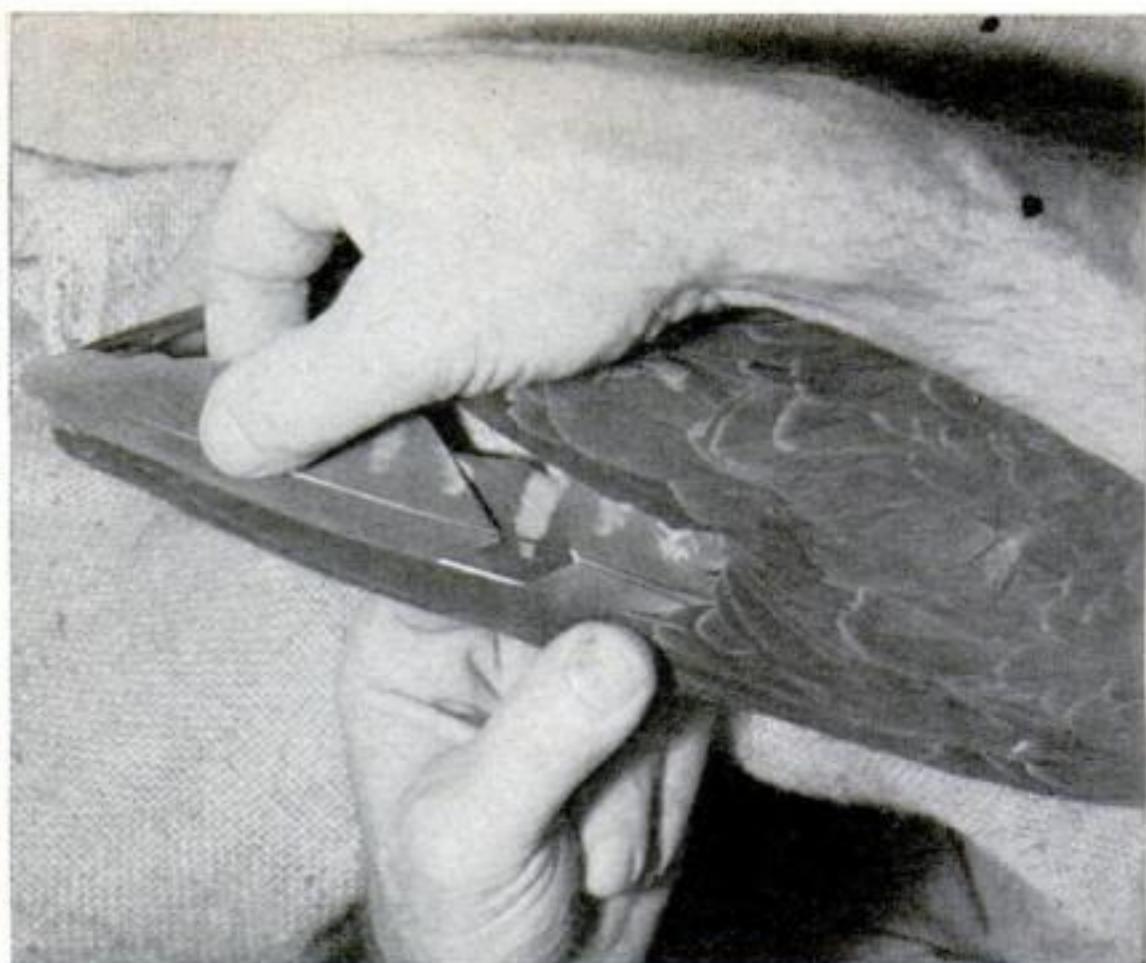
To the falconer, a hawk's wings are sails; its legs are arms; its breast feathers are mail; and its claws are pounces. When a falcon grows tame, it is said to come to; when it is thoroughly trained it is well entered; when it is in good hunting condition, it is in yarak. The bird bates when she flutters off her perch; she rings when she rises spirally in the air; she mantles when she extends a wing and a foot simultaneously in stretching at her perch; she mews when she molts; and she foots well when she is successful in knocking her quarry from the sky. A bird as large as a grouse, struck at the end of a peregrine's stoop, sometimes hits the ground so hard it bounces fifteen yards.

To produce such hunting hawks, falconers use two types of raw material: birds taken





**SPARE FEATHER.** A broken wing feather is not allowed to impair efficiency. A replacement is cut from a spare and a pin is inserted in the shaft



When the other end of the pin is fitted into the shaft of the original feather, the wing is as good as new. Note the careful matching of the feathers

from the nest, or eyess falcons, and birds trapped by means of bow nets and decoy pigeons, or haggard falcons. To train the wild hawks, the falconers follow an age-old procedure.

During the early days of this training, the birds are kept hooded and, as they are carried about on the gloved fist of the falconer, they are stroked frequently with the feathers of a dried pigeon's wing to soothe their nerves. Feeding the captive hawks raw beefsteak—about five ounces of lean meat to a meal—or freshly killed pigeons, while they cling to the gloved hand, trains them to associate the hand with feeding. A low whistle or other distinctive sound is made by the falconer while the bird eats. Later, at the sound, the hawk will return to the fist. From time to time, tiring, or plucked pigeon wings, are given the hawks. They tear off bits of the meat, worrying the wings for half an hour at a time. This keeps their beaks in good condition.

When the birds are partially tamed, the hoods are removed and replaced by the falconer during feeding time until the birds become used to the procedure. Now, the hawks can be left unhooded outdoors in what is known as weathering. Sitting on cork-topped blocks of wood, they become accustomed to the sight of people and animals. An unhooded, or barefaced, hawk seems happier when there is some activity around it.

Advanced steps in training begin with teaching the hawk to eat from the lure. This is a flat object too heavy for the bird to carry and too soft to injure the hawk if

it stoops on it in the air. It is sometimes made of a horseshoe well padded with tow and covered with leather and feathers. Lean beefsteak, tied to the lure, attracts the hawk. First the bird is permitted to eat the steak on the ground; then the lure is swung about the head of the falconer and the hawk stoops on it. To train the hawk to wait on overhead, the falconer hides the lure after attracting the bird and makes it spiral around for longer and longer periods.

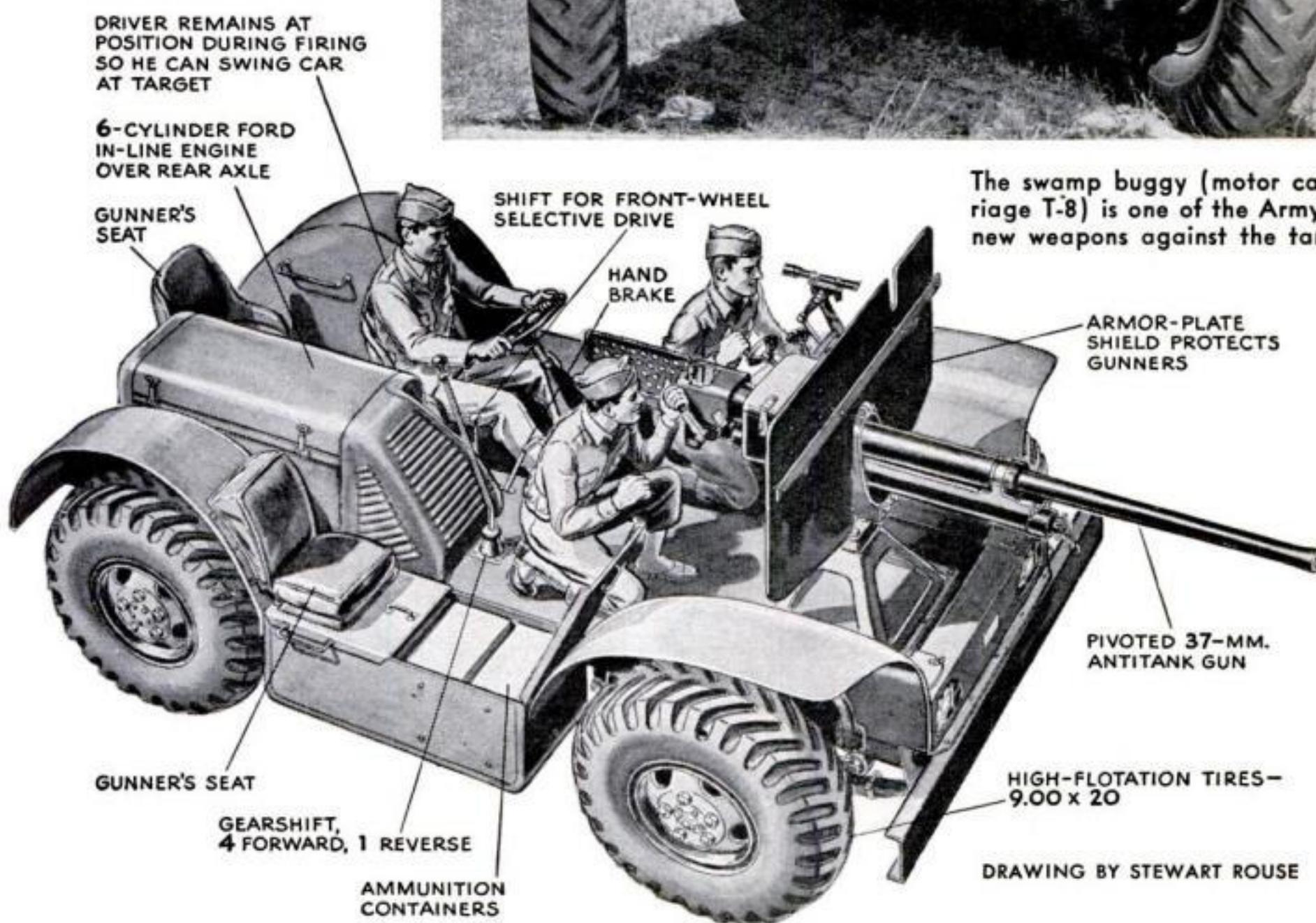
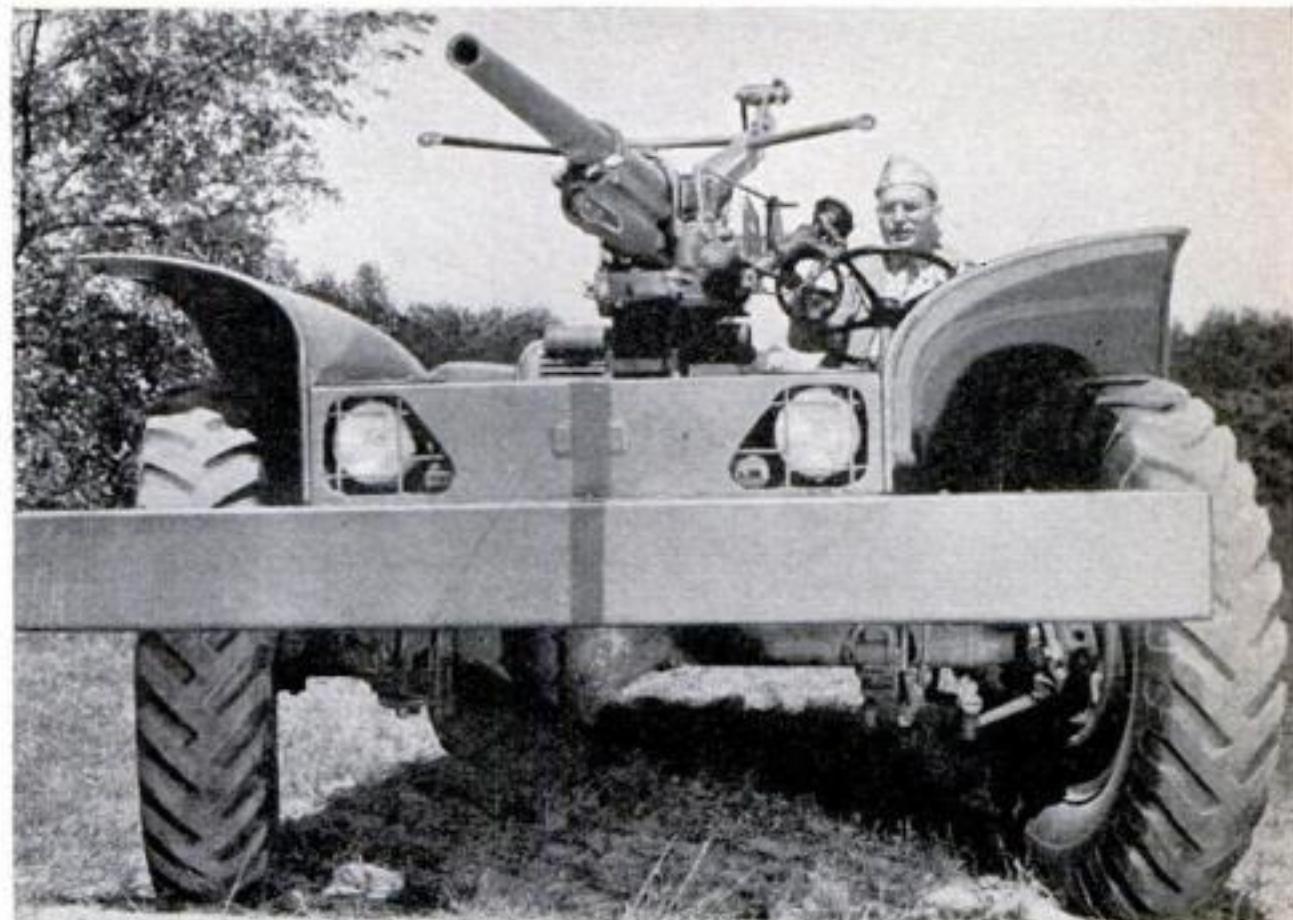
In falconry, two methods of hunting are used. In one, while the hawk waits on overhead, the falconers, often with the help of dogs, flushes birds from coverts below. In the second method, the hood is removed and the hawk freed when flying game is sighted.

This kind of hawking requires expert handling of the hood. In one method of fastening the hood, the falconer takes the longest drawstring on the left side between the thumb and middle finger of his right hand. Then, by pressing against the base of this drawstring with the index finger, he gives a steady pull with the thumb and middle finger, closing the hood. It is now easy for him to draw the other string tight with his teeth. Later, to strike the hood, he simply draws the strings and the hood is ready to be slipped off instantly.

The peak of interest in this sport came in the Middle Ages, when falconry was so popular that hunting birds were allotted according to rank. Kings got the eagles; princes the gyrfalcons; earls the peregrines; priests the sparrow hawks; and servants the useless kestrels.

# Tanks CAN Be Destroyed

**Land Battleships  
Meet Their Match  
in Hard-Hitting  
and Fast-Moving  
New Gun Carriers  
to Run Them Down**

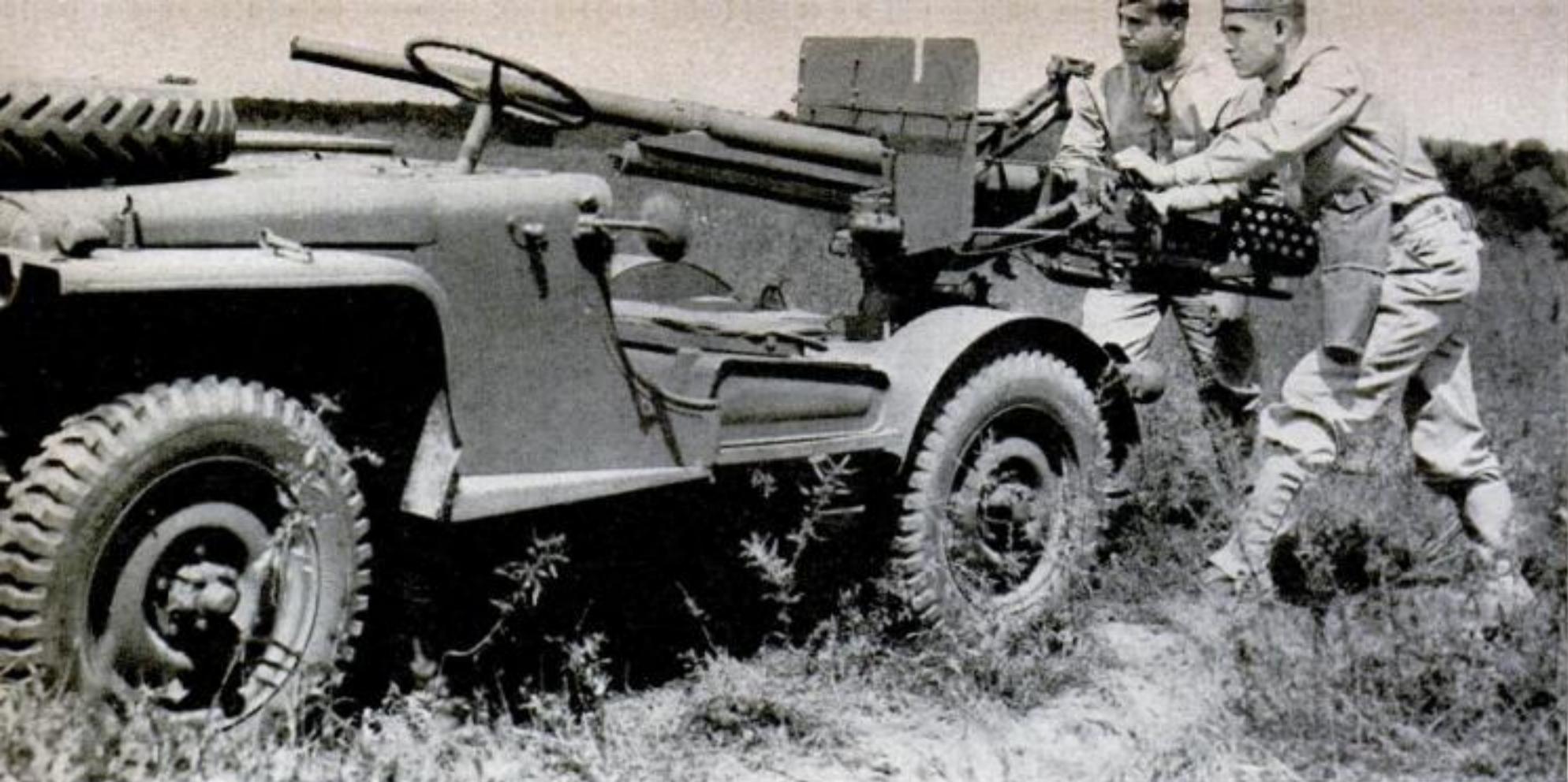


**By HICKMAN POWELL**

WHEN America's mechanized columns clattered into battle in the recent war games of the armies, they encountered a new type of weapon and a new style of tactics which on more than one occasion gave their tank battalions a thorough kicking around.

Fast, inconspicuous, and powerful, firing from ambush and bursting forth in sudden surprise raids, came swarms of tank destroyers—armor-piercing guns on self-propelled mounts—which could outspeed, outmaneuver, and outshoot the heavy armored battle wagons lumbering down upon them.

Tanks can be destroyed. And the American Army is getting ready to do that job,



Carried by the famous quarter-ton reconnaissance truck (bantam car), this 37-mm. gun can be swung around on its swivel mount. Photos below show it aimed forward and to rear with the car in motion. The first mount of this type was made by Col. B. Q. Jones from an old Ford differential casing



As shown below, the muzzle of the gun can pass under the steering wheel when it is swung sideways



without waiting for factory production to put us on a basis of tank-for-tank equality with potential enemies. The new weapons for the purpose are simply ingenious adaptations of guns and carriers already available in vast quantities. The destroyer units into which these guns are being organized—with unprecedented mobility and concentration of fire power—are a purely American innovation in the art of mechanized war. They substitute an up-and-at-'em pugnacity for the old antitank practice of placing guns and waiting for an attack by the enemy's land battleships.

The basic heavy weapon of the new tank-destroyer units is the old 75-millimeter gun. The 75 is capable of stopping any tank—if it can get into position and fire quickly enough. But up to now it has been mounted on wheels and towed behind a truck with muzzle pointing to the rear. To move it, either into action or away, precious minutes

must be lost in limbering and unlimbering.

The 75's new tank-destroyer mounting—with muzzle forward, ready for point-blank fire—is on one of the Army's new armored half-track personnel carriers. The half-track truck, with steering wheels in the front and endless-tread tracks behind, can do 50 miles an hour on the highway and can move rapidly across country over terrain where a tank can go.

Thus mounted, with modern fire control permitting rapid aiming and firing by one man, the 75 becomes a most formidable destructive weapon. Indeed, it practically becomes a myriad of such weapons, for the half-track is *already* in mass production—coming off the assembly lines of three big truck factories.

That will permit its lavish use in concentration of fire, and the Army is preparing for that kind of use. The first provisional tank-destroyer battalion, for instance, was

This is another version of the 37 on a jeep. Set on a higher mount, it fires forward over the engine with a limited traverse. This car carries a crew of four men



A sub-caliber barrel inserted in the gun enables the crew to practice firing without wasting costly 37-mm. shells. This barrel fires .30 caliber bullets



given a complement of 36 of these guns. That is equivalent to the field-artillery power hitherto assigned to a whole infantry division! And if many are lost in battle, America can always make gun carriers a lot faster than any other nation can make tanks.

Junior partner with the mobile 75's is the 37-millimeter antitank gun, souped up for armor piercing and mounted on the new bantam cars (jeeps) and a still newer military vehicle known as the swamp buggy. Unarmored, save for light shields across the gun mounts, these light vehicles are to be used for flank protection of the 75's and for fast hit-and-run fighting. They are so small and of such low silhouette that they can be hidden in practically any patch of bushes. The idea is for them to operate as sharpshooters, ready to cut and run for new cover as soon as discovered.

The mounting of the 37 on the little jeep is merely one new angle on the myriad uses

of the tiny car. But the swamp buggy, known officially as the motor carriage T-8, is something new, with exciting qualities all its own.

The swamp buggy was developed as a cargo carrier, by the Ford Motor Company. It consists of little more than a platform, four big wheels, and an engine (the new Ford in-line, six-cylinder.) The whole thing stands less than four feet high, and most of this altitude is in the balloon tires (9.00 by 20) which are 38 inches in diameter. The engine rests over the rear axle, at the right, and driver and gunners sit beside it. The antitank gun is mounted all by itself on the forward deck, ready for instantaneous action. With wide selective range of power and speeds, it can pass almost any pleasure car on the open road and can ride its big tires over almost any kind of ground—including soft spots where a tank would bury itself. It is so low it can hide in a weed patch.

Before this past year, the obvious way of combatting tanks was to build better tanks and more of them. But as a result of the tank shortage a whole flood of Army ingenuity was turned loose and within a few months the basis had been laid for a whole new technique of tank fighting with self-propelled guns. Even now, before the quickly devised weapons have been provided to troops in any great numbers, it is obvious that they are only a beginning.

No one man or group of men is responsible for this development, but one example of the kind of creative work that went into it is the case of Col. B. Q. Jones. Colonel Jones, veteran of the Air Corps, was assigned last year to cavalry at Fort Bliss; and incident to his duties was the testing of that new-fangled little car, the bantam jeep. In the



A half-track personnel carrier makes a self-propelled platform from which a 75-mm. gun can be fired point-blank at tanks. For maneuvers, this unit is simulated by rolling a regular carriage-mounted 75 onto a truck, as shown at the right

process he developed an idea all his own.

Last February he took the rear end of an old Ford truck, cut the differential casing in two, and turned it into a mount for a 37-millimeter gun. Then he took out the rear seat of a jeep, and in its place he put the gun, so swiveled that it could fire in several directions from the parked car. At first, when shooting sidewise, the little car would jump about seven inches with each shot; but when the mount was cut down a few inches she stood solid, absorbing recoil in her tires. There was a lot of skepticism, of course, about so insubstantial a mount for an artillery piece. But when the Jones gun hit a gasoline barrel three times out of four, at a range of 500 yards, it certainly was not to be ignored. Colonel Jones went to Washington, assigned to G-3 of the War Department. There, in the Training and Operations Division, he found a whole group of men thinking along the same lines as himself.

Soon Ordnance came out with its own version of a 37 on a jeep. This gun sits on a higher mount than the Jones gun, firing forward over the engine. In rapid succession came the development of the half-track and the swamp buggy as gun mounts. Designs are being made for a heavier jeep, better to stand a heavy gun.

Rapidly also came organization of new



outfits to use the new weapons. Up to this time, the basic unit for protection against tanks had been the antitank company of each infantry regiment, charged with the local protection of its own troops. Last July, after a four-day pow-wow of antitank men, the War Department embarked on the formation of 23 provisional antitank battalions, designed for the protection of larger units. Drawing on its own field artillery, each infantry division formed such a battalion. Nine still stronger battalions, for the protection of army corps, were put together from the field-artillery brigades, and instructed to work together in groups of three ready to take the initiative against any strong enemy armored column.

The new guns weren't ready yet, but soon old-fashioned 75's were hoisted into 2½-ton

trucks and lashed down with muzzles pointing forward. In other trucks, pine logs were set up as simulated guns. While waiting for armament, the battalions went to work on tactics. A whole new structure of antitank defense and tank destruction had been superimposed upon the Army.

At the base were the old antitank companies, the same as they had always been. Then each division had its provisional antitank battalion. In a square division this consisted of two batteries of 12 37-millimeter guns and two batteries of 75's, with eight guns each. In addition the battalion had a company of engineers, equipped with thousands of mines to be strewn thickly in the path of probable tank attack. This divisional antitank battalion, numbering about

475, has the function of protecting its own division from any mechanized break-through, after the fashion of halfbacks on a football team.

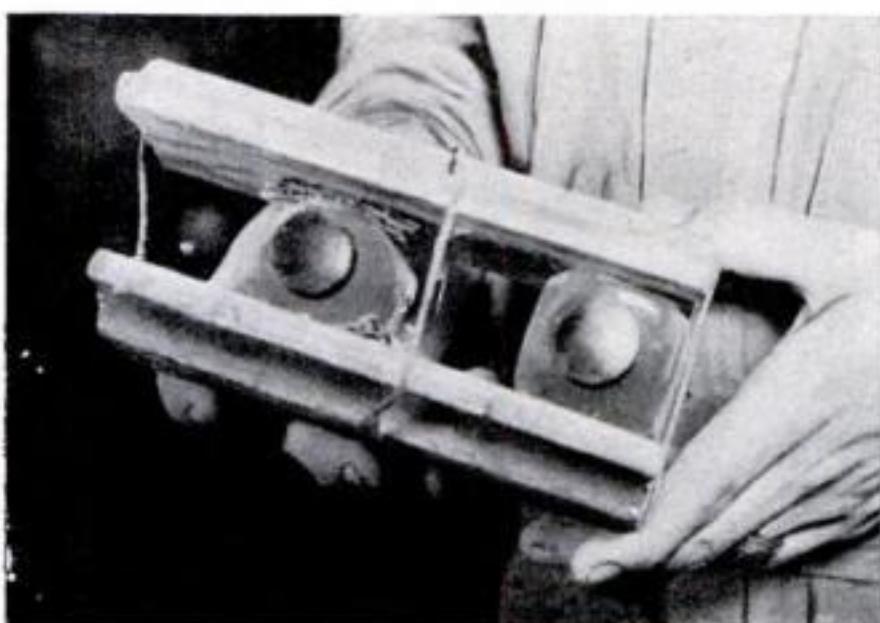
The antitank battalions from the field-artillery brigades, organized in GHQ groups and armed entirely with 75's, were assigned the more aggressive role of seeking out and combatting any major mechanized attack.

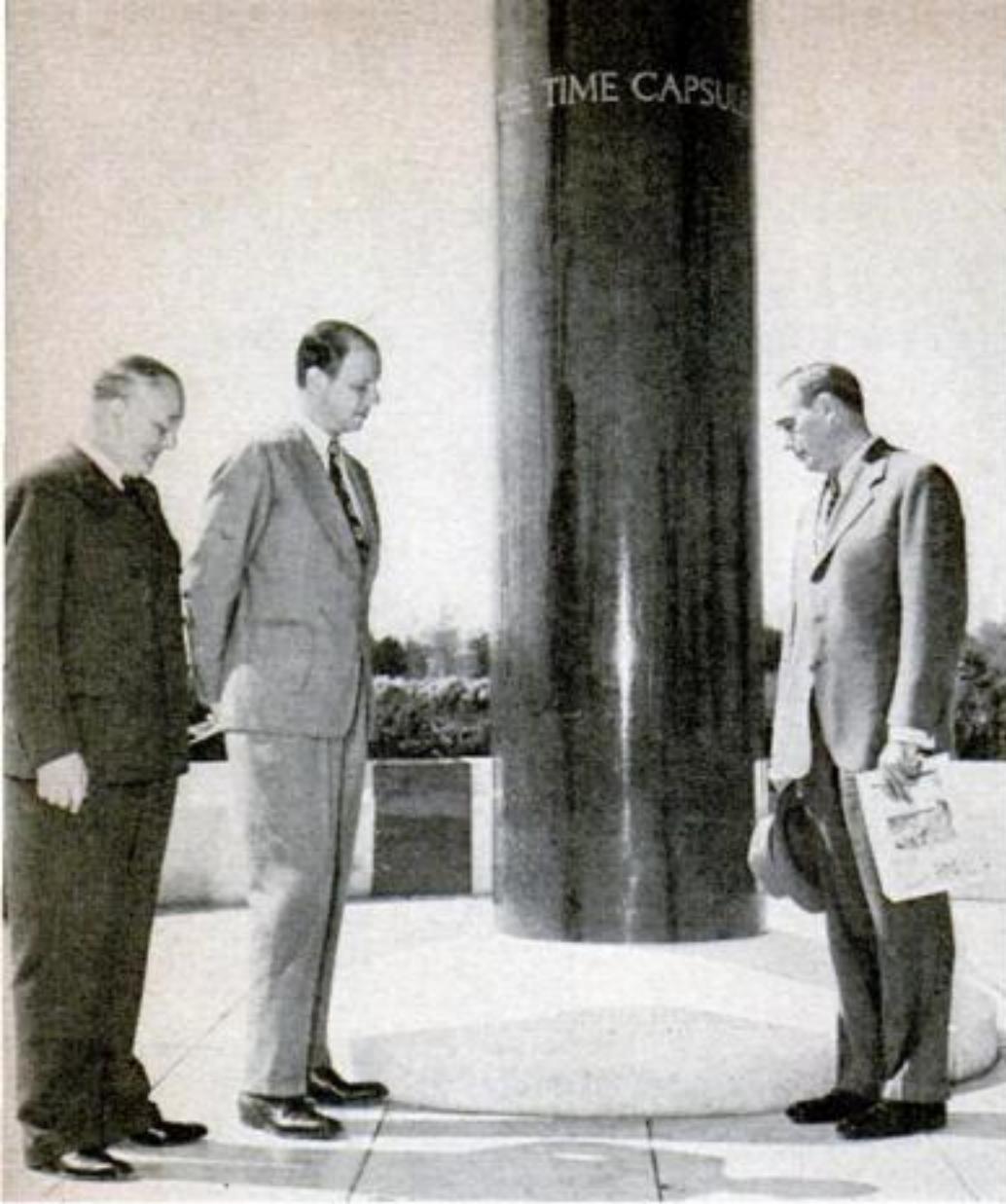
Then, on top of all this, came the General Staff's real innovation, the provisional GHQ tank-destroyer battalion, of which it is planned to mobilize a large number. Note that it is not "antitank." The whole philosophy of antitank tactics in the past has been to meet the enemy when he attacks. The whole idea of the tank-destroyer outfit is that it shall go out (*Continued on page 220*)



Mines, too, are poison to tanks. Here a truck is striking a make-believe mine planted by the "enemy" in maneuvers. Any tank or vehicle that hits one of them is marked down by the umpires as "destroyed"

Dummy tank mines consist of bottles of chemicals wired together between boards. Planted inconspicuously on the field of action, they produce puffs of smoke when crushed under wheels or tank treads



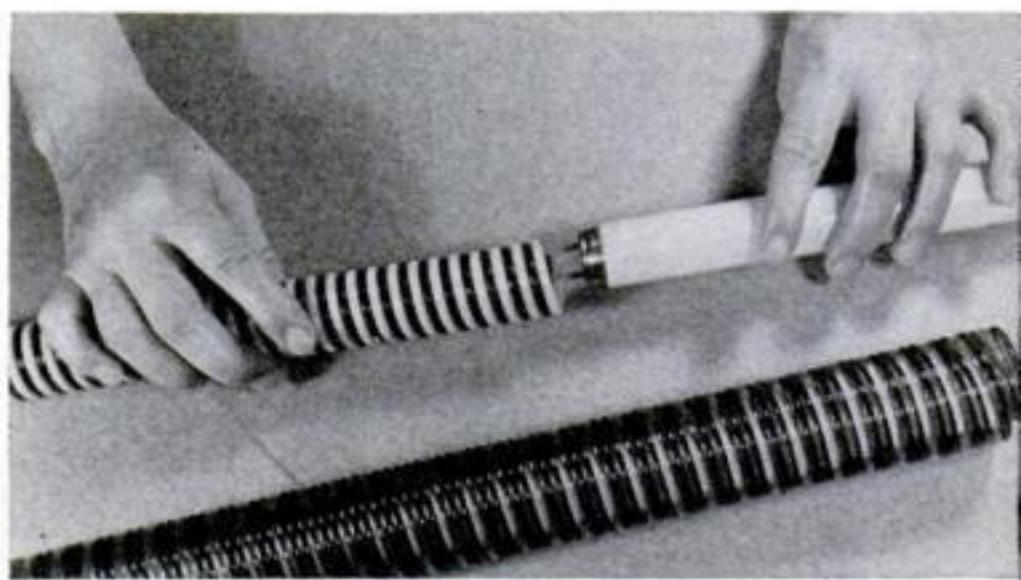


## Granite Shaft Guides Diggers of 6039 A.D. to Time Capsule

A BLACK granite shaft, recently erected at the site of the New York World's Fair, now marks the location of the Time Capsule, the 800-pound "letter to the future" buried September 23, 1939. Fifty feet beneath the shaft, the metal cylinder contains familiar objects in use today and microfilm recording 10,000,000 words of printed matter. The shaft will indicate where people in 6039 A.D. can dig for the capsule.

## New Alloy Improves Tin Foil

GREATER strength and increased immunity to chemical reaction with foodstuffs are provided by a new kind of tin foil produced by scientists at the Tin Research Institute, in England. The new material is formed of an alloy made up of 91.35 percent tin, 8.5 percent zinc, and 0.15 percent nickel.



## Plastic Coils Temper Light from Fluorescent Tubes

SPRINGLIKE coils of plastic material now control the character of light given off by fluorescent tubes. Ordinarily blue, yellow, and green rays predominate. By slipping on a coil in which red and white strands alternate, red rays are added to the light. The coils are expected to have special value in beauty parlors, clothing stores, and meat markets, for accurate judging of color.

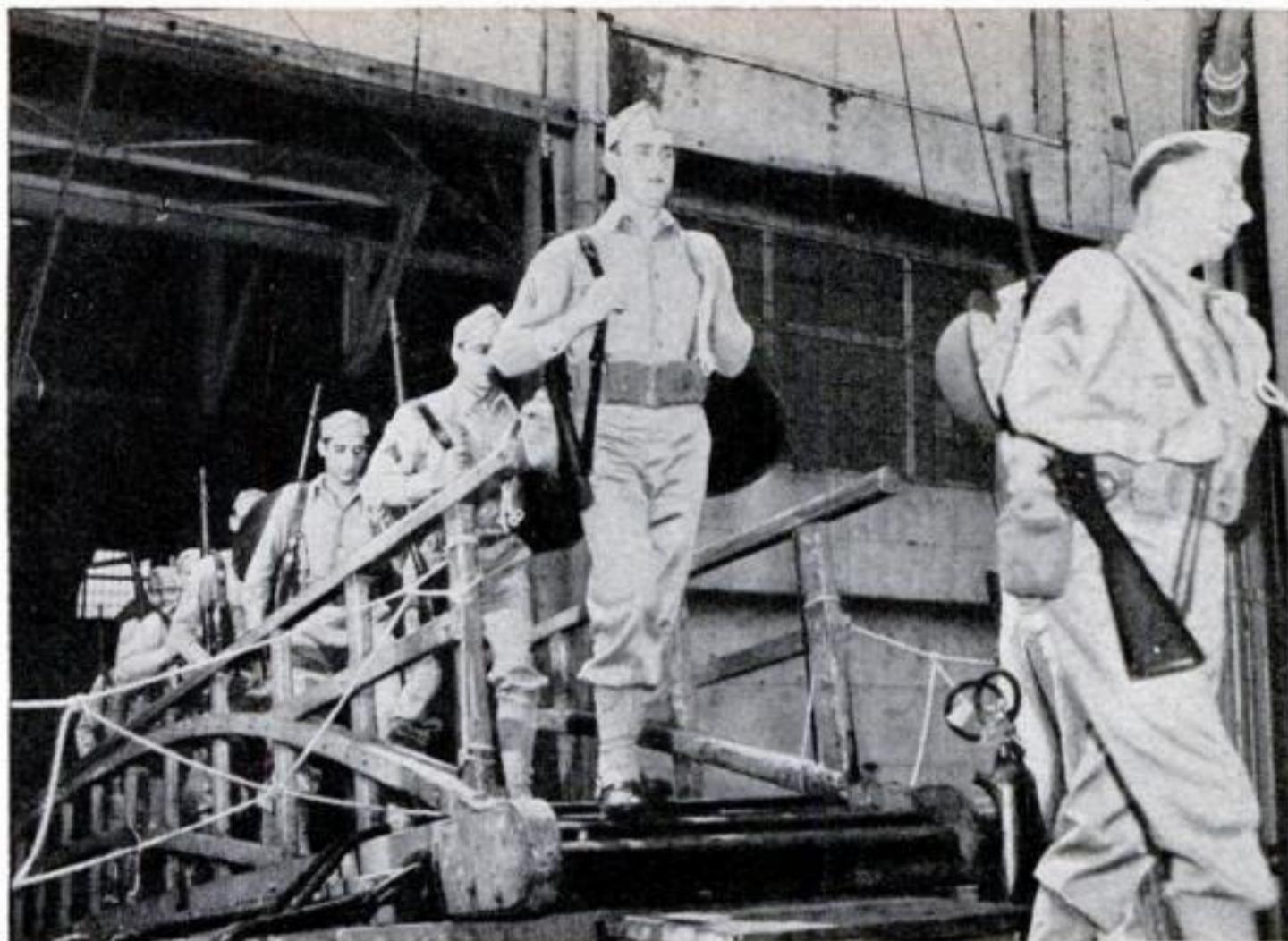
## Insects Go on the Air from Miniature Broadcasting Studio

BUILT on the same principles as a real broadcasting studio, a miniature sound-proof room, only ten inches by ten inches, recently enabled officials of the Bronx Zoo, in New York City, to broadcast sounds produced by grasshoppers, crickets, centi-

pedes, and spiders. The single microphone on the floor of this insect studio picked up even such tiny sounds as the swish-swish of a centipede's legs. Five square feet of acoustical material went into the construction of the soundproof box.

Earle Chace, curator of insects at the Bronx Zoo, coaxing one of his temperamental pets into the "studio." Below, a tarantula gives all to the mike





## MODERN TROOP TRANSPORTS ARE Seagoing Combat Units

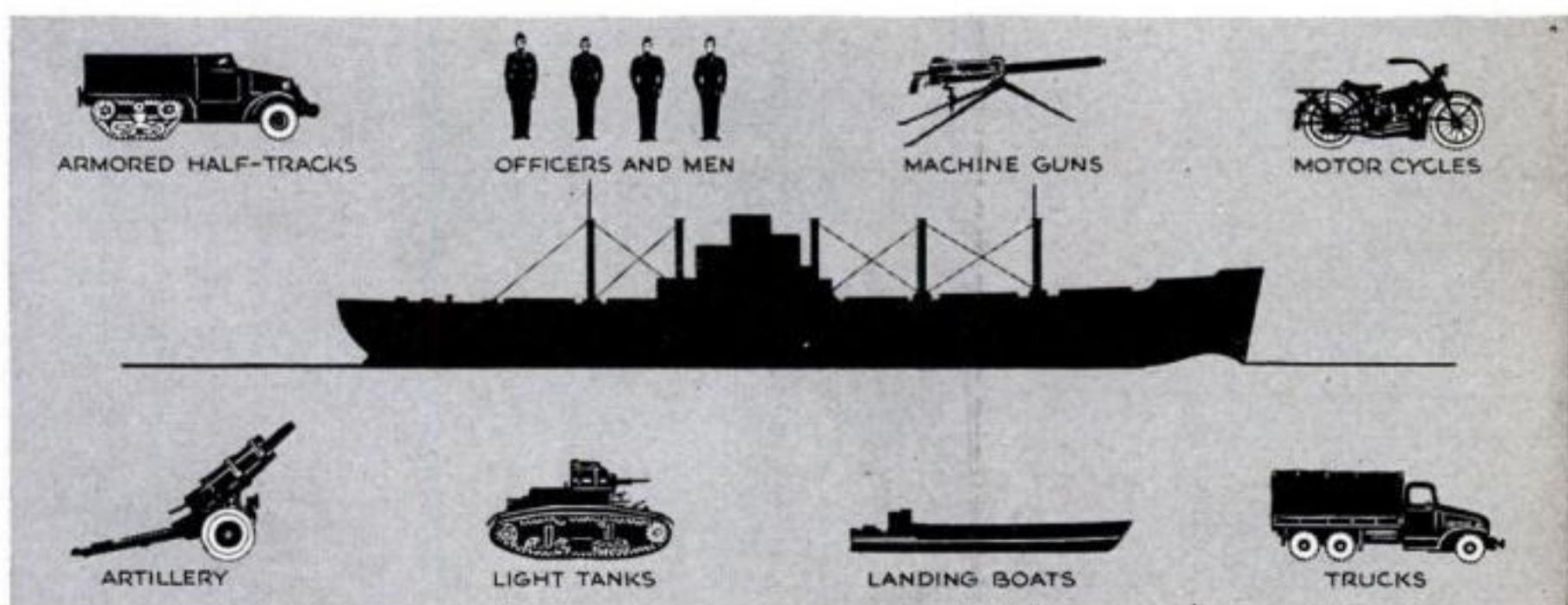
THE nation's armed forces have perfected a new system for the sea transport of American troops. Every troop-carrying ship will become a fighting transport bearing a self-contained combat unit, fully equipped and with each man in fighting gear and trim, ready to do battle the moment it is landed. The new method, which depends upon the fullest coöperation between troops and crew, has been tested in simulated invasion landings on American shores.

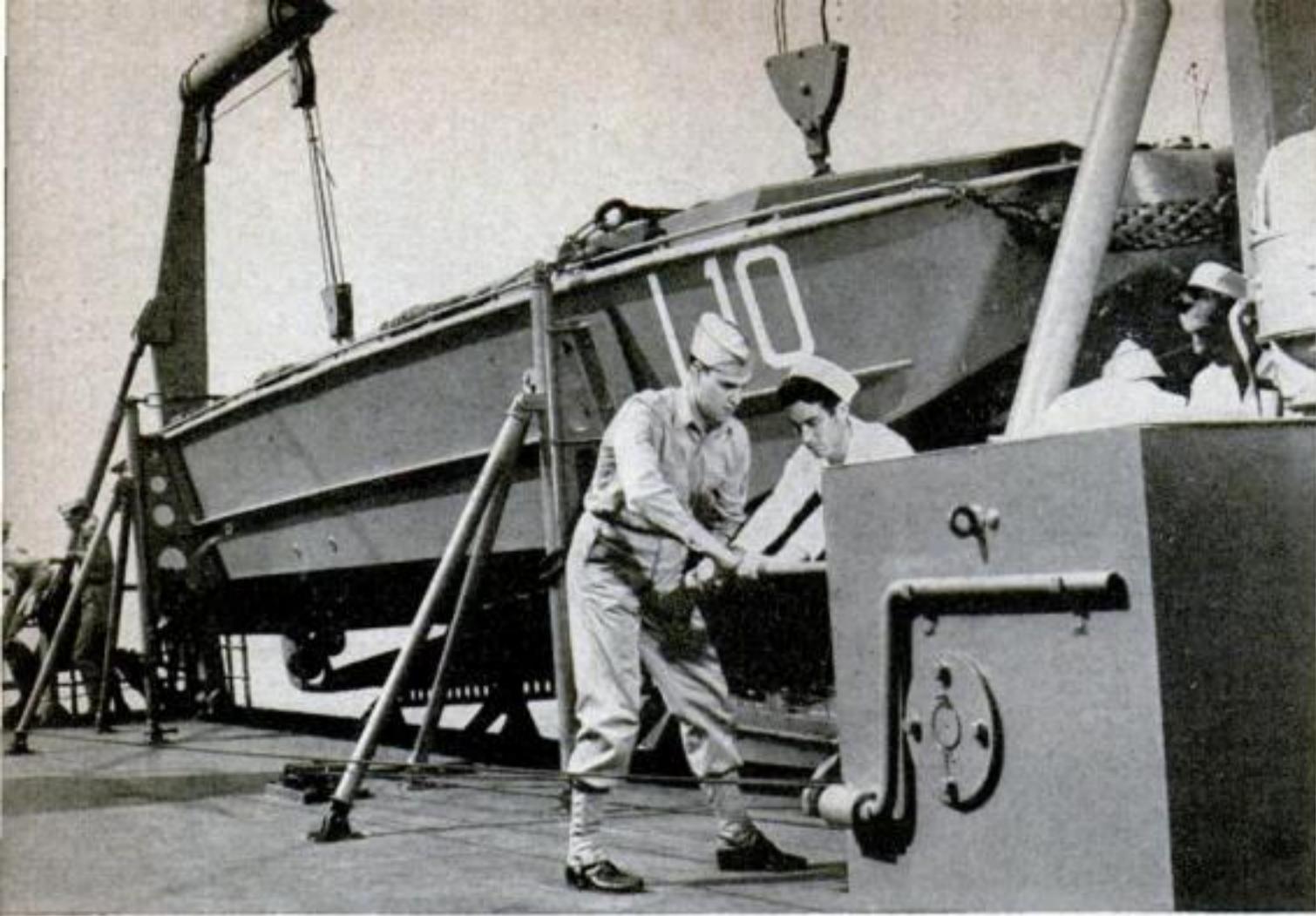
The new transport concept differs sharp-

ly from that used by the United States in World War I, when 2,000,000 troops were carried across the Atlantic on American and British troopships. Men and equipment were dumped casually aboard the transports then with little regard for their eventual use.

This hastily prepared transport plan was effective in 1917-'18, when there was ample opportunity to unscramble the cargoes of the vessels when they were deposited safely in Allied ports on the other side. But it seems

New loading system makes each transport a self-contained fighting force with all material and equipment



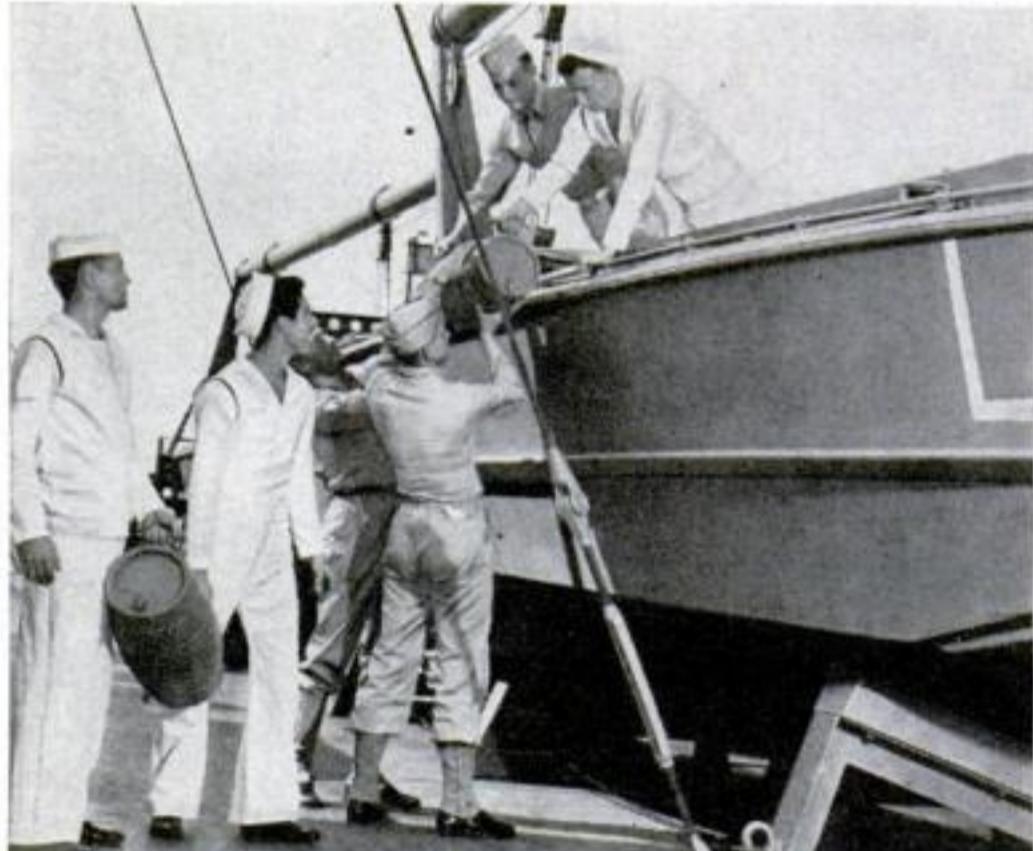


Soldiers and sailors join hands at cranks that swing a boat over the side. Powered by gasoline or Diesel engines, boats can run up on a beach

Landing boats for use in landing troops are stowed like lifeboats on each transport and are launched by means of davits. A landing boat like this takes men and equipment enough to hold a beach head. Larger landing boats carry more men and also ferry light tanks, guns and cars



Food and water are stored in the landing boats. If enemy action makes it necessary to abandon ship, the landing boats are used like ordinary lifeboats

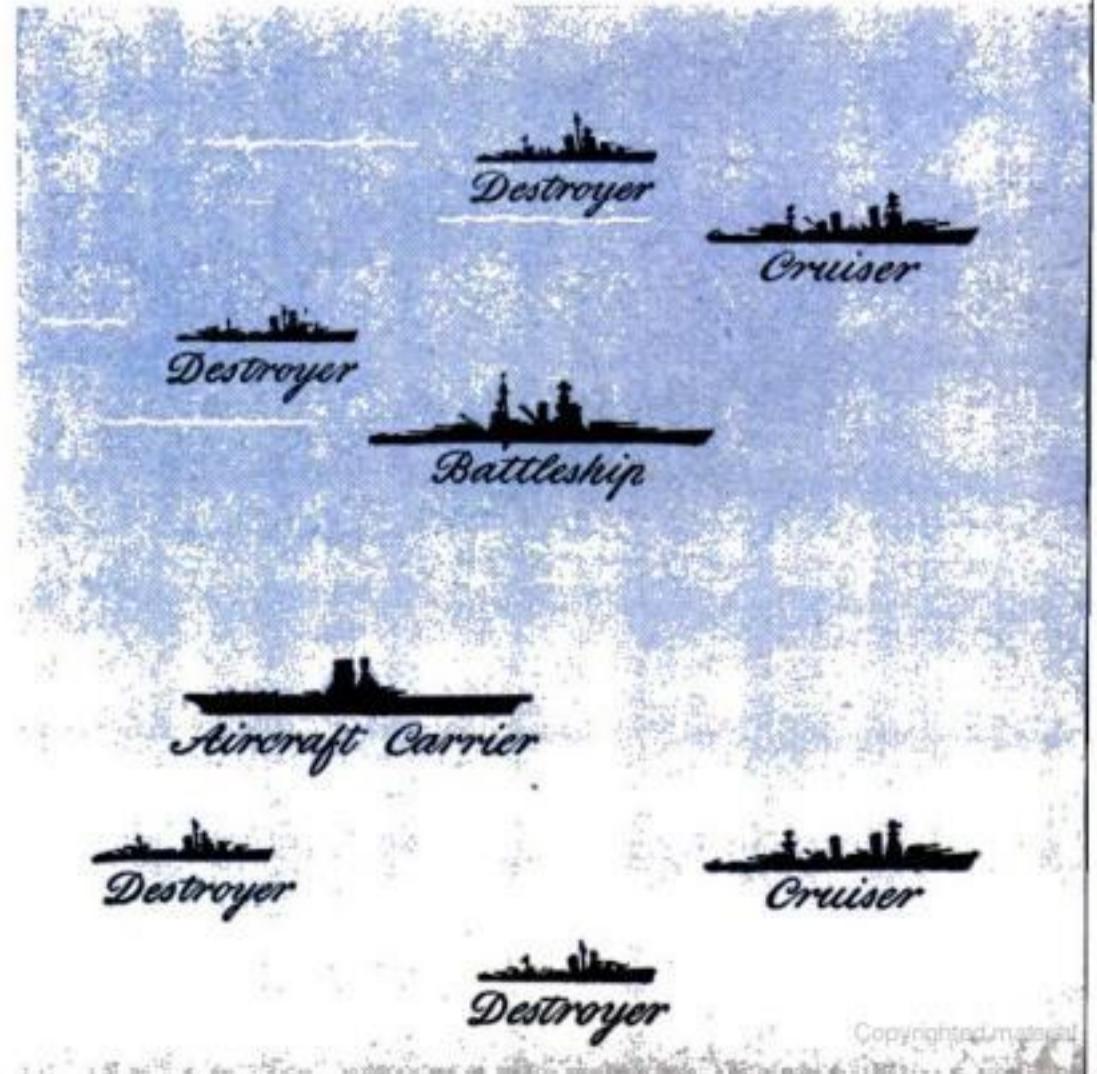


obvious that the same system would not work now.

In fact, this type of loading did not work in World War I when Sir Ian Hamilton tried it to land an Allied force at Gallipoli. His troops, inadequately equipped and poorly organized to invade an enemy-defended shore, were forced to withdraw.

It is possible that an American force sent on a combat mission in the present world situation might not find a friendly shore on which to effect a landing. Hence the new fighting transport was devised and made standard practice. It is simply an adaptation to the sea of the land combat unit which has been perfected.

One of the valuable American lessons of the first World War has been observed in



the new transport tactics, however. The result is that most transports, whatever their load or destination, are operated by the Navy with Naval officers in command. Whether the troops are soldiers or marines, the Navy is in authority while the transports are on the high seas.

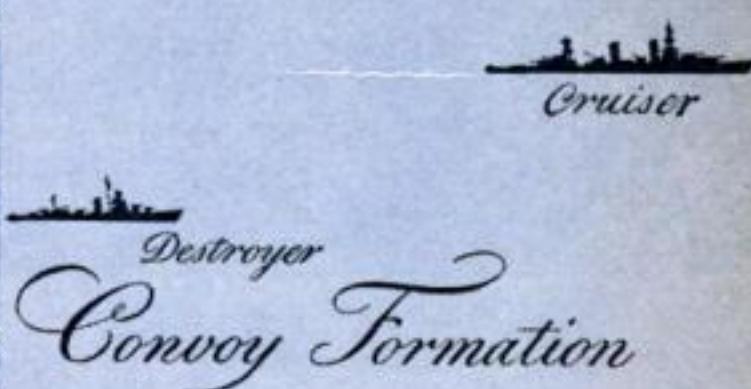
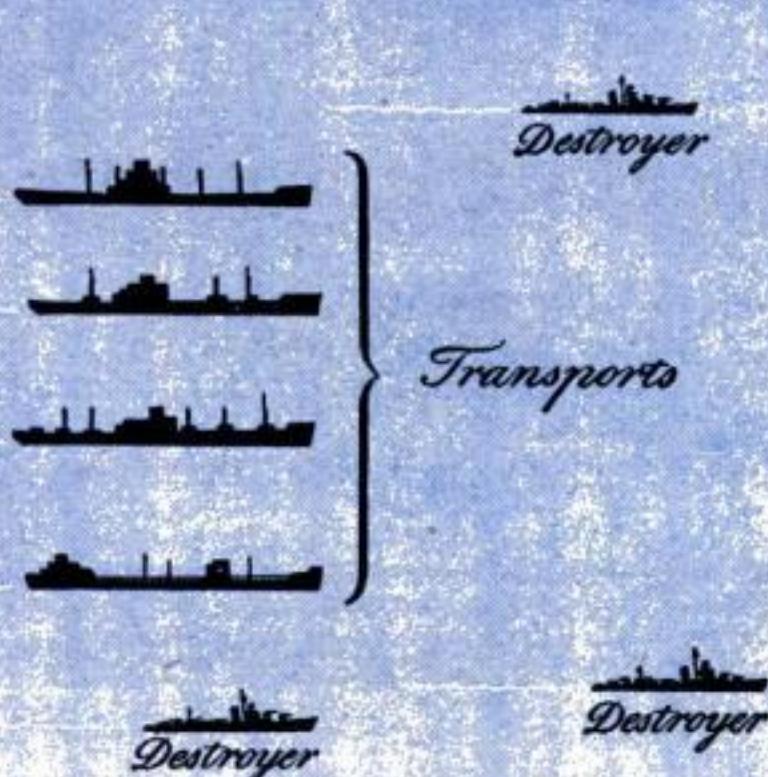
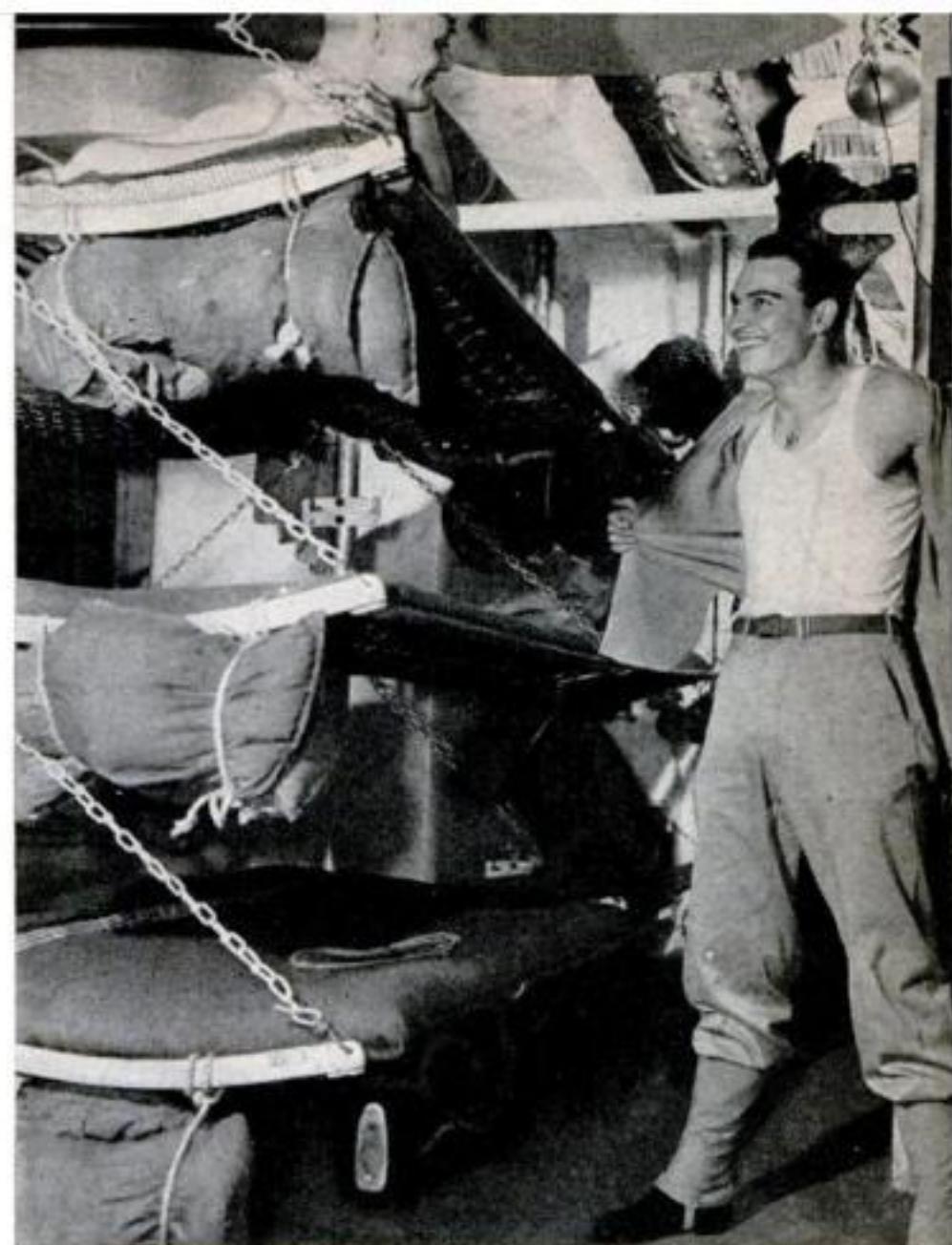
Not only are Navy officers in command, but the transports are manned by naval ratings. Furthermore, although there is little chance they will ever be landed for fighting ashore, the Naval personnel on a transport is considered part of the vessel's combat unit. The sailors might be used, for instance, to operate the landing boats which place the troops ashore.

At present there are three types of transports. The first class consists of former Army transports which have been taken over and are being run by the Navy as regularly commissioned Navy ships. The second class is made up of vessels which have been built or bought by the Navy, which operates them to carry troops. The third class consists of ships operated under Army supervision with civilian captains and crews. Some transports of the third class are being taken over by the Navy.

Before the United States entered the war against the Kaiser, the Army administered all its own transport service. The crews were recruited from the merchant service. In 1917 our troopships in a submarine-infested ocean were convoyed by the Navy.

Coöperation between the two branches, an absolute prerequisite in modern war, has

Holds of the transport are veritable floating barracks. Each man has a berth, under which he slings his life preserver, rifle, and other equipment. He also has a locker for his clothes. Troops are made as comfortable as possible, as they may have to live aboard ship for weeks or even months at a time



Artist's conception of a transport convoy with its naval escort. The troopships are steaming abreast, with a screen of destroyers, while a cruiser leads the van and a battleship, an aircraft carrier, more cruisers bring up the rear

Copyrighted material



FOOD is prepared three times a day in large galleys and is served out to troops in cafeteria style. The men eat at long tables which can be lifted out of the way, as seen below, to clear the space when they are not in use. Compactness is the keynote aboard modern fighting transports. Guns, vehicles, and other equipment must be carried as well as men



eliminated possible difficulties over the problem of divided authority.

On a recent visit to a port of embarkation some transports were on hand which had been refitted to carry troops. The ships have been arranged structurally to carry a combat team each as an expeditionary force. The loading is done to make each ship a fighting transport, with each vessel carrying a self-contained combat unit. All supplies and equipment for this force are loaded on each ship.

Tanks, artillery, machine guns, armored cars, trucks and motorcycles, and other equipment sufficient for the unit are stowed in the holds. The troops are allotted berths in the holds, each man having a bunk and locker for his clothes.

These transports are veritable floating barracks. Almost every convenience that obtains ashore is provided on board the ship. Large galleys or kitchens supply the food which is served out on the cafeteria system three times a day. Wash rooms, showers, barber shop, canteen, tailor shop, all add to the comfort and convenience of the men.

The health of the troops is an important task for the doctors. On each ship there is

a large sick bay or hospital where daily sick call is held, inoculations given, and medical treatment provided. There is a dentist and dentist's chair and a complete outfit of dental instruments to care for the men's teeth.

The most up-to-date system of communications is provided each ship. Radio rooms are complete. Blinker lights, signal flags, and hand flags are resorted to when at sea for intership communications. Radio silence is observed at sea for safety's sake, for a lurking submarine can locate a ship by radio direction finder.

Stowed on board each ship are a number of landing boats to be used to transport troops to shore. Some are gasoline-engined and others have Diesel engines for propulsion. They can be run up on shelving sandy beaches and the troops unloaded. Each boat carries a small unit of men with equipment enough to hold a beach head. In addition to these smaller landing boats, larger boats are provided each transport that are capable of carrying a light tank and landing with it on the beach.

Let us follow a theoretical expedition of transports to sea. The transports are loaded and leave the dock. Before leaving the har-



**SICK CALL.** Health of the troops is the care of the ship's doctors. In the sick bay, or ship's hospital, inoculations are given and treatment is provided for any illnesses that may develop among the many men aboard



**GOING TO THE DENTIST** is one of the less pleasant advantages offered aboard a transport. Each ship has a dentist's chair and a complete outfit of instruments. Among the more popular facilities are wash rooms, showers, barber shop, canteen, and tailor shop

bor they are joined by a naval escort of a size depending upon the opposition to be expected. It might have one battleship, several cruisers, six or eight destroyers, and an airplane carrier, if air opposition is apparent. The transports would be formed in line abreast, and the speed would be that of the slowest ship of the group. The battleship and aircraft carrier would take station astern of the transports, with a cruiser ahead and on the flank. The destroyers would encircle the ships and guard against submarine attacks.

On being attacked by submarines, the destroyers would lay depth-charge barrages. If a transport is torpedoed and sunk, the expedition would proceed as planned, for the unit sunk would merely reduce the force. No essential material that would be needed for the expedition would be lost. Of course, the troops would be rescued by the destroyers and escort vessels. This method of loading the transports, by which they are self-contained in material and equipment, not only preserves the integrity of the expedition in case of casualty, in not losing some particular equipment that might be essential to the expedition, but also makes the group

flexible in that a transport can be picked out of the group and sent off on an eccentric mission, and be capable of landing its force with all of their equipment.

These transports have been converted from merchant ships, mostly cargo vessels. An attempt has been made to make the lot of the soldier on these transports as comfortable as possible, for the troops on each ship may be forced to live on board the transports for many weeks if not months before being landed.

The crew of the transport and the troops are trained to work together as a team. The troops are available as guards, lookouts in crow's-nests, as crews of boats, as cooks in the galleys, and to serve out the food. Only the work appropriately belonging to the sailor is performed by the crew of the vessel; practically all else is performed by the troops.

One of the most important drills is that of bringing on deck the entire crew and the troops to the vicinity of the boats when danger threatens. When the alarm sounds all hands proceed to their stations for "abandon ship." Booms are rigged out for hoisting out the *(Continued on page 220)*

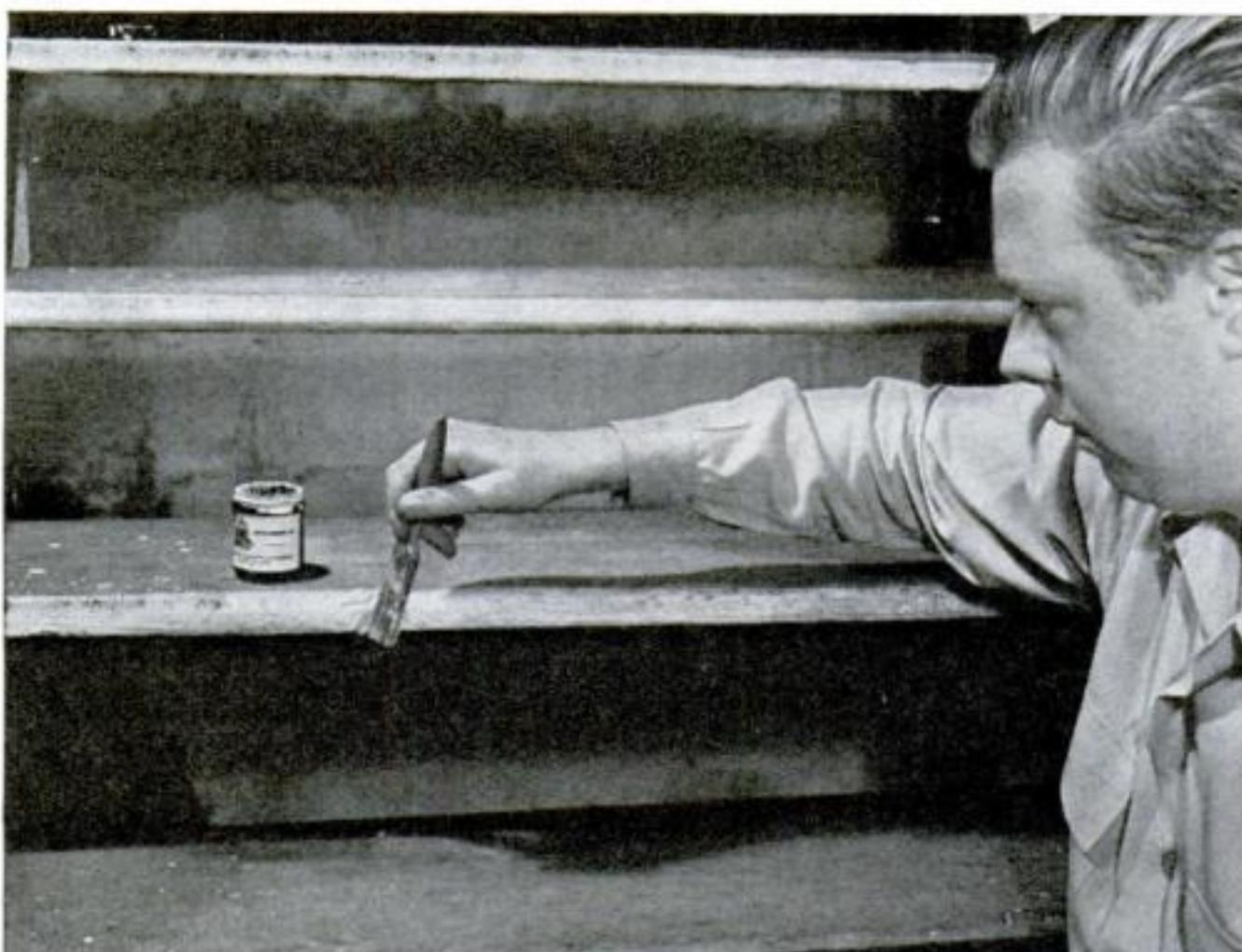
# LIGHTING WITH PAINT

## New Luminous Coating Has Many Practical Uses in the Home

LUMINOUS paint of improved composition, especially developed for practical purposes rather than as a toy or dramatic stunt, now makes house numbers, doorknobs, keyholes, and bedroom slippers easy to find in the dark. It marks danger spots such as stair treads and electric fans. Besides these household uses, it may be employed on highway markers, boats, docks, and buoys. The newly marketed cream-colored paint, after brief exposure to daylight or artificial

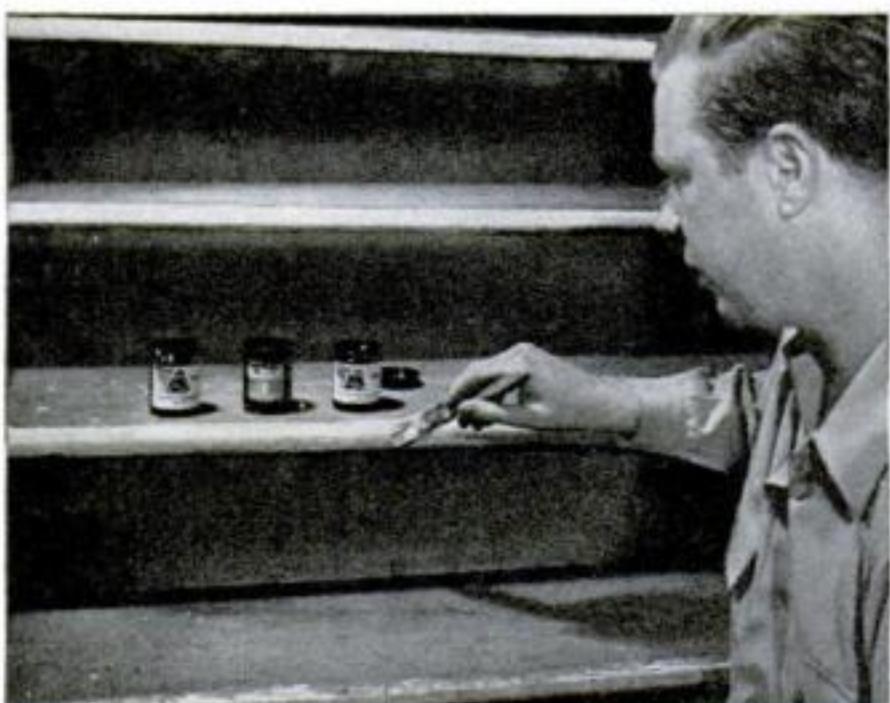
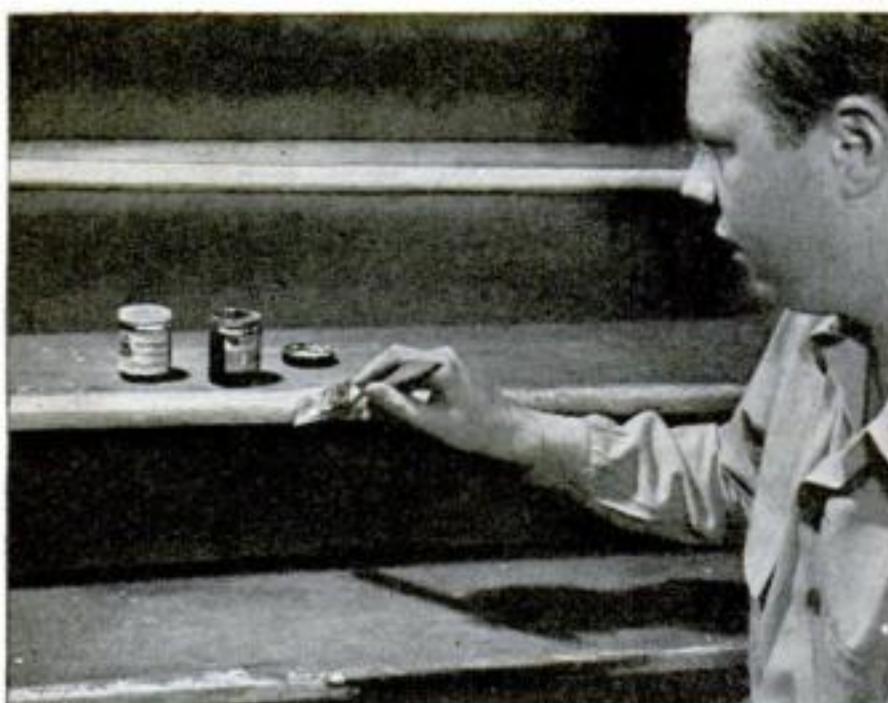
illumination, emits a soft blue-green glow.

By flying a kite above New York rooftops, and then plucking off adhering metallic particles with a magnet, a chemist found enough of them in city air to have an adverse chemical effect on sensitive luminous paints. Certain ingredients of ordinary paints also prove harmful. Therefore the luminous agent of the new preparation is combined with a special medium of liquid plastic and is put up only in glass bottles.



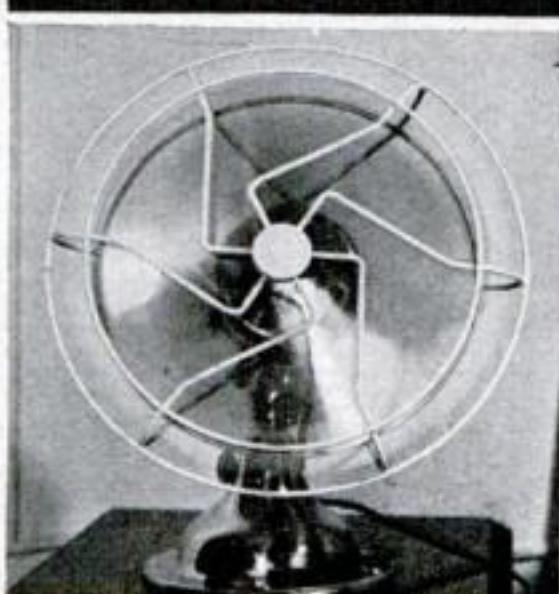
Applying the new luminous paint to edges of stair treads. A special white priming coat goes on first, as above, to prevent contact of the paint with varnish. Then comes the luminous paint itself (below)

The final touch—a clear, transparent finish especially compounded to guard the luminous agent from deterioration caused by dust, dirt, and airborne substances. It also makes the paint washable





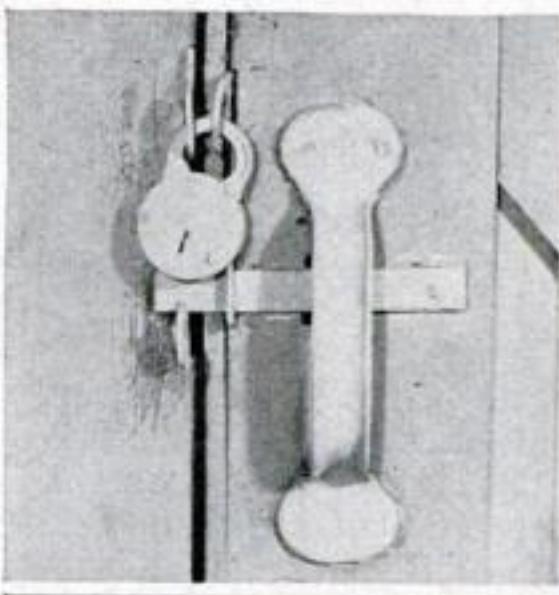
This doorknob is easily found in the dark. By daylight, paint gives it an attractive color



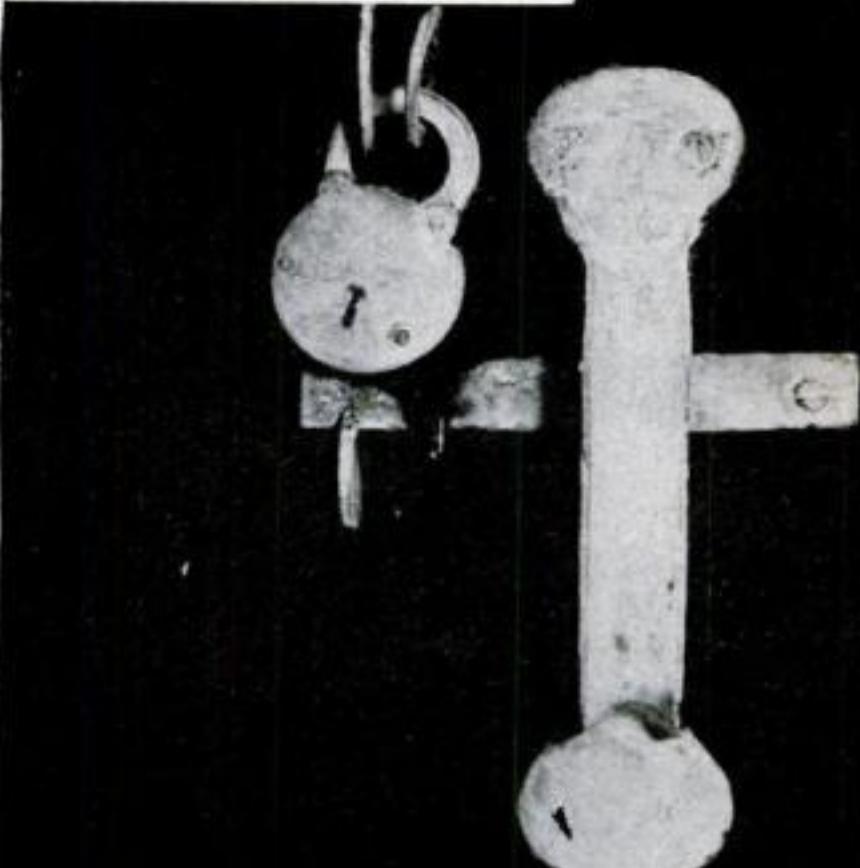
With lights out, this luminous fan guard gives warning of danger lurking in whirling blades



No groping for slippers trimmed with light. The paint does not alter their daytime looks



Fumbling at the garage door is ended when padlock and latch are coated with luminous paint





## "Taxi" for Bombs Aids Police in Fight on Sabotage

A "HURRY-UP WAGON" especially designed for bombs has been devised by the police department of Bridgeport, Conn., which has a large concentration of defense industries and is taking special precautions to prevent damage by sabotage. The device, also known as a "bomb taxi," is a cylindrical tank, reinforced by heavy cable and mounted on a two-wheeled trailer. When an object suspected of explosive capacities is discovered, a police emergency truck dashes to the scene with the "bomb taxi" bouncing behind it. The object is dumped into the tank, where it is made harmless by an oil bath, and is trundled off without further danger.

## Rescue Belt Helps Firemen to Carry Victims on Backs Like Knapsacks

A RESCUE BELT that makes it easier to carry fire victims from burning buildings has been made standard equipment for each member of the Monrovia, Calif., fire department. The belt consists of a large loop of heavy web belting equipped with a sliding metal hook. The rescuing fireman places the belt, doubled, around the back of the victim, and by putting his arms through the two loops at the ends he can lift his burden like a knapsack. His hands are free for climbing. The hook is placed so that it rides horizontally on the fireman's shoulder; when he needs a rest, he can slip it over a rung of the ladder to support his load. The belt also helps in carrying hose up the ladders.

This rescue belt with hook for resting the fireman is in use, in the photo on the right, for carrying victim down a ladder. Fireman's hands are left free to grip the rungs in climbing



# Cheaper Power for Defense Industries

## MAMMOTH EARTH-AND-CONCRETE DAMS WILL HARNESS LAZY SOUTHERN COASTAL RIVERS IN VAST PROJECT

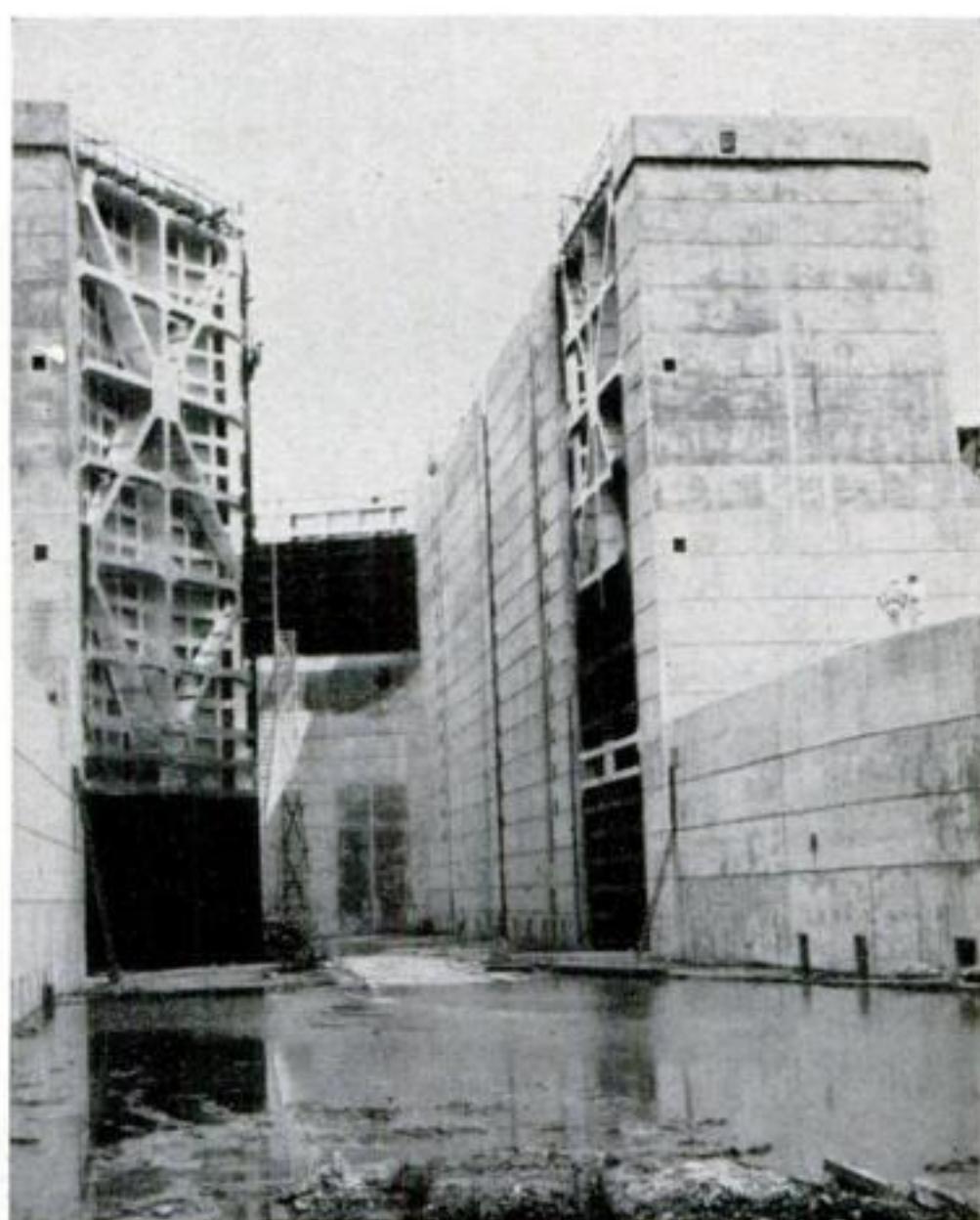
ONE of the most important hydroelectric plants in the Eastern United States is taking shape in the low country of South Carolina, an area commonly believed to be too flat for the development of hydraulic power. Originally designed as a peacetime power and navigation program, this Santee-Cooper project will be finished in time to provide cheap electricity for new defense industries.

A new plant to manufacture high-grade alloy steels in electric furnaces is already under construction in Charleston to utilize the new power source. Other defense industries are also projected for the South Carolina coastal plain, which lack of an adequate power supply has long kept industrially backward.

Two broad, winding coastal valleys have been bottled up with huge earth-and-concrete dams to form the new project. The dams will create two vast reservoirs to provide a head of 75 feet

of water to operate the hydroelectric plant. The reservoirs will be linked by an eight-mile canal and given outlet to the sea through one of the highest lift locks in the world, forming an inland waterway system to serve much of the state.

The main source of water is the Santee River. Winding through a valley which was



The highest lift lock in the world, shown under construction at the right, forms a part of the Santee-Cooper power and navigation project detailed in the map below. It will raise vessels 75 feet to the new Pinopolis Reservoir



once little more than a cypress swamp, the Santee flows into the Atlantic 45 miles north of Charleston. It drains nearly half of South Carolina and, at flood stage, passes 368,000 cubic feet of water a second, one and one-half times the maximum flow of the Hudson River at Troy, N. Y.

Across the lower reaches of this valley at Wilson's Landing, S. C., has been thrown an earthwork dam eight miles long. The central section of the dam is a 3,400-foot concrete spillway equipped with 62 sector gates to control the level of the Santee Reservoir which will be backed up for 35 miles behind

it and will cover an area of 150 square miles.

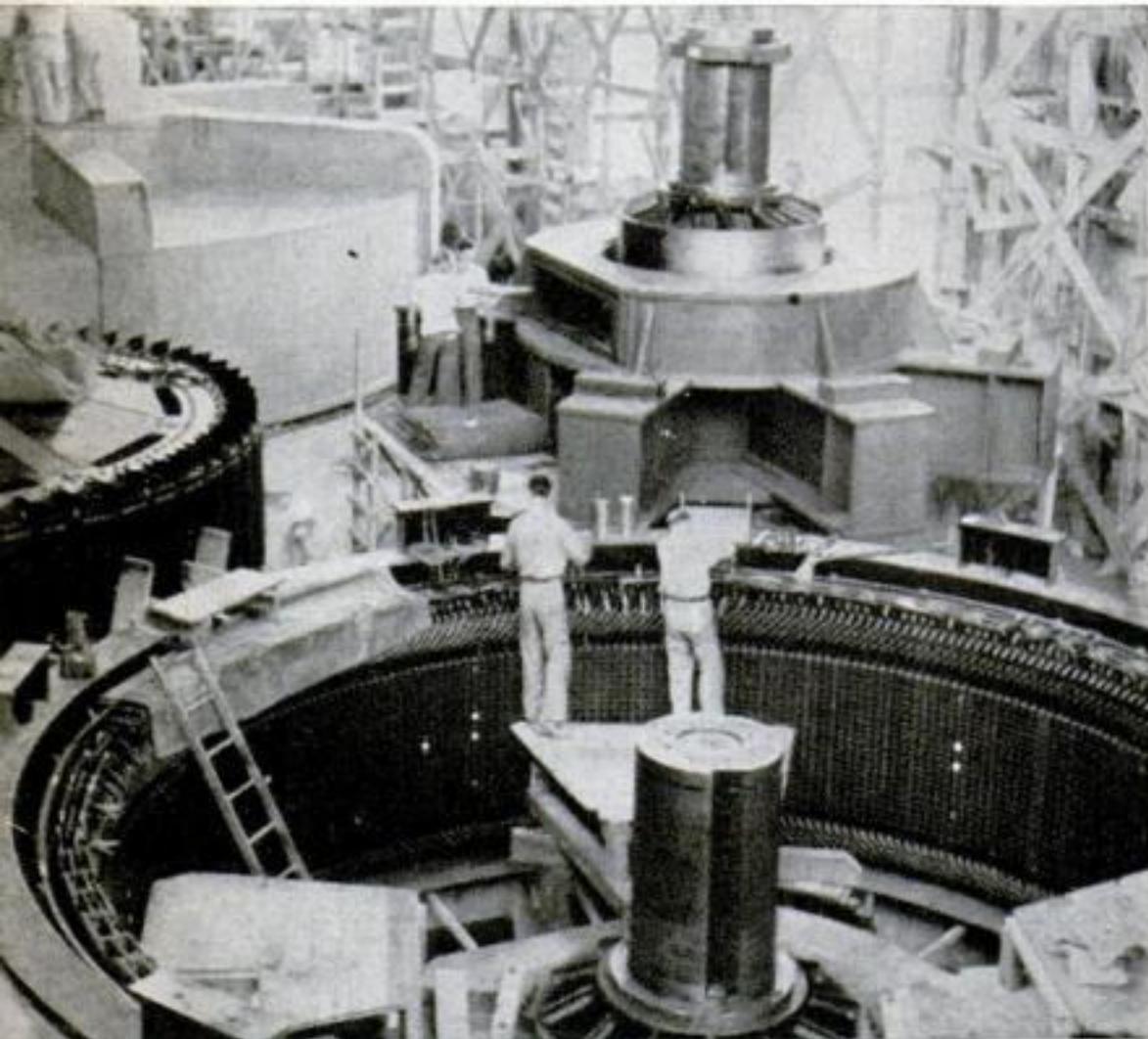
The Santee River near Wilson's Landing swings to the south. This brings it near to the head of another large valley, formed by Biggin Creek. This drains into Cooper River, a tidal stream flowing into Charleston Harbor.

The excavation of 7,000,000 cubic yards of dirt in a cut across the low ridge separating the two valleys made possible the opening of a connecting canal. The Biggin valley was then closed by the construction of earthwork dikes to fill out the ridges and hills which partially surround it and the building

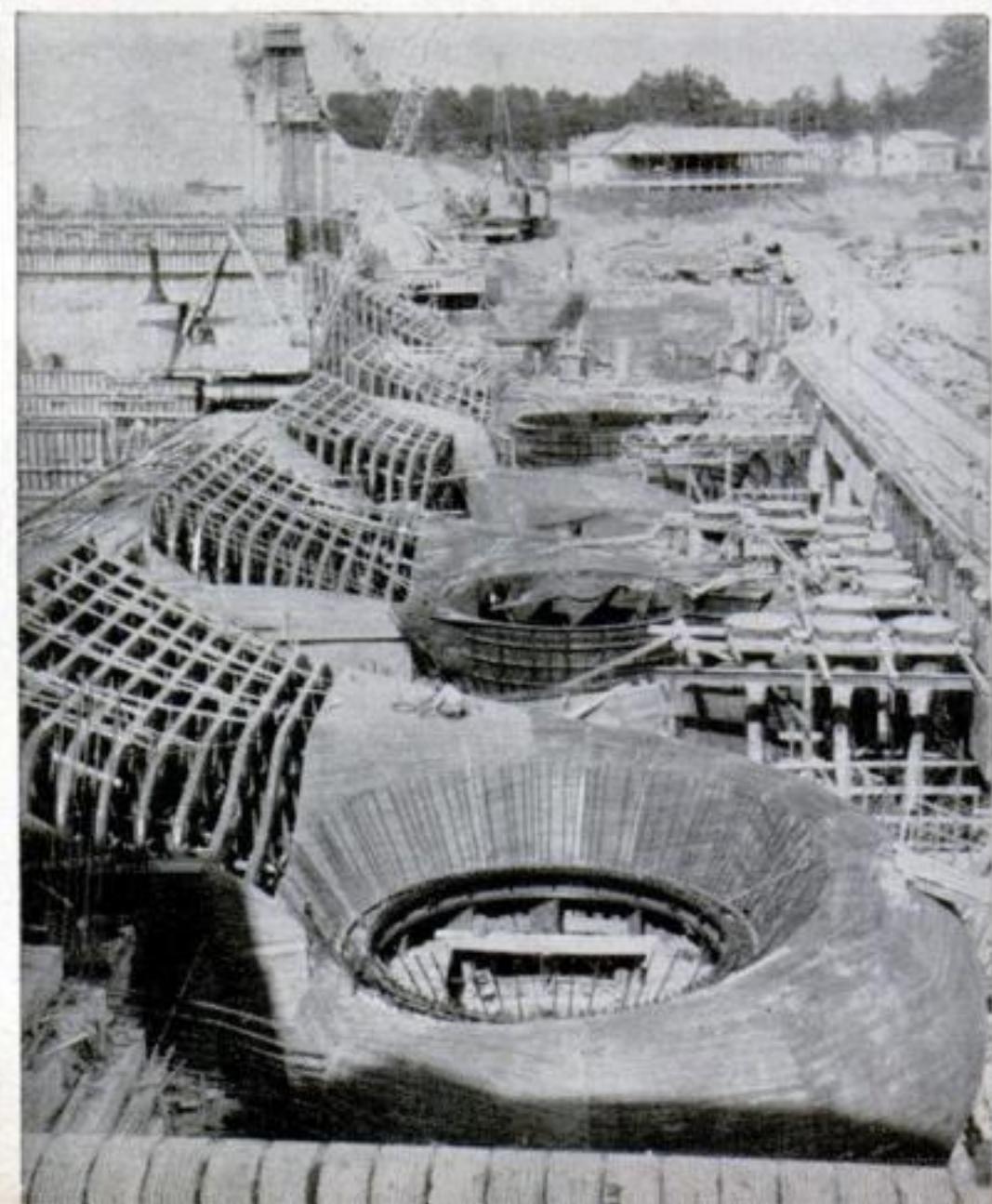
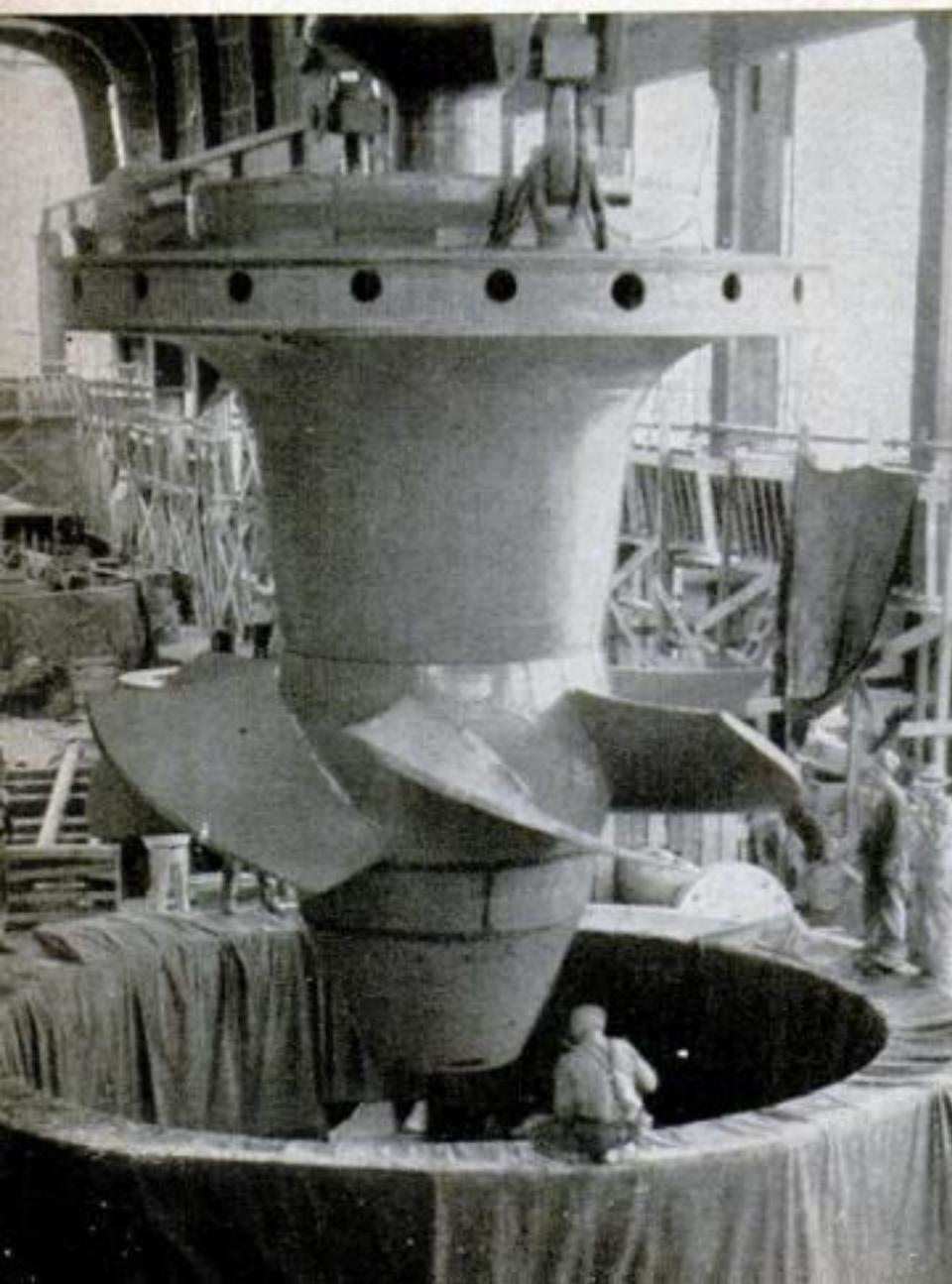
of another earth dam across the lower valley just above where it empties into the Cooper River.

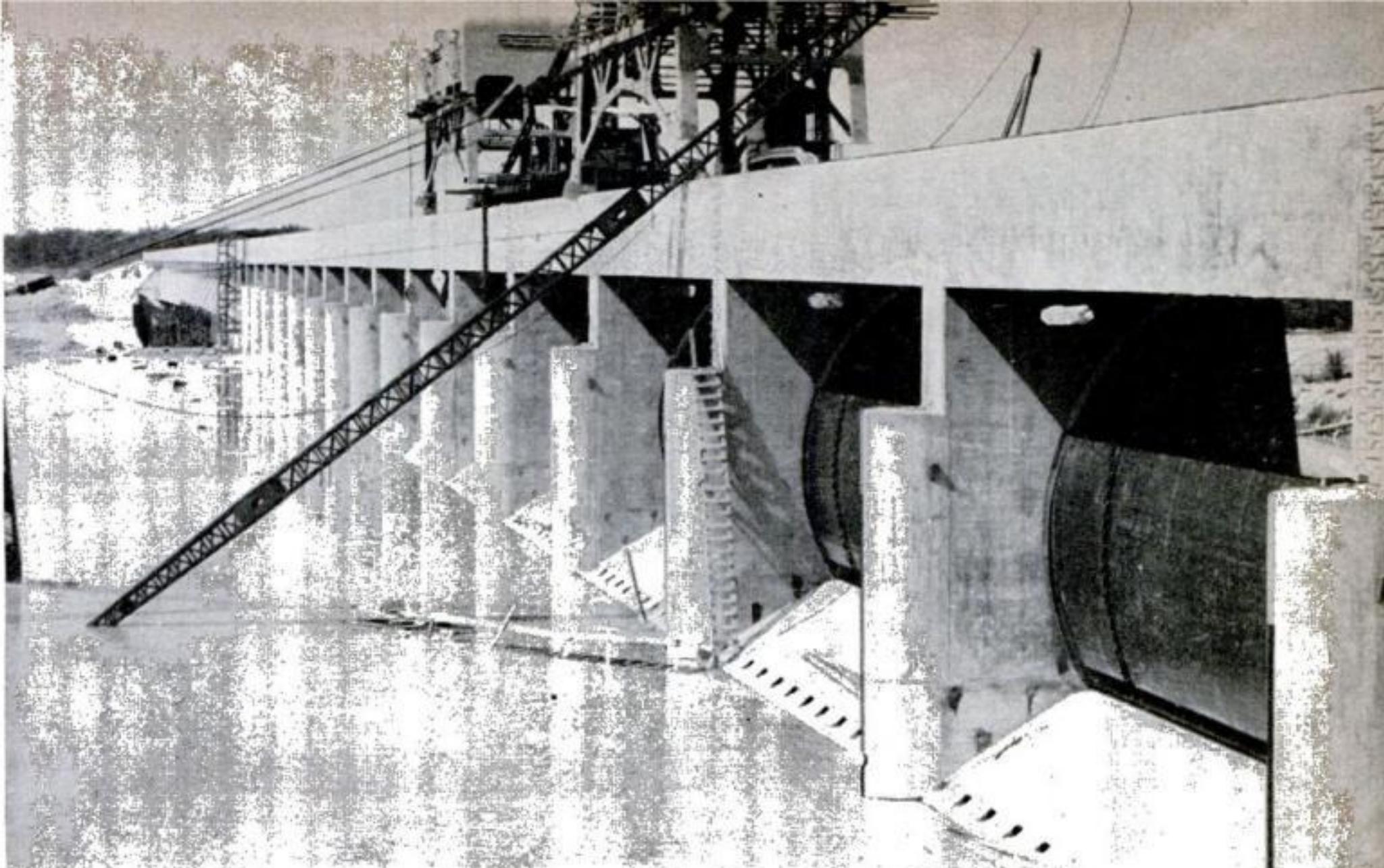
The resulting Pinopolis Reservoir, fed by both Biggin Creek and the overflow of the Santee Reservoir, will have an area of 100 square miles. At the highest point of the earthwork dam a short gravity section of concrete has been built. The hydroelectric plant and the lift lock will be integral parts of this dam section.

The electric plant, built directly in front of the dam, is being



At left, workmen are connecting the windings of the stationary armature of one of the 13,800-volt, 34,000-kilowatt generators. At lower left, an adjustable-blade runner is being lowered into place in a 40,000-horsepower turbine. Below is the bottom section of the power house, showing forms around which the concrete scroll cases for turbines will be poured





This is the upstream side of the concrete spillway which runs for 3,400 feet along the middle of the eight-mile Santee earth dam. Right, form for one of the turbine draft tubes at the Pinopolis plant

equipped with five turbines, four of 40,000 horsepower and one of 13,000 horsepower. The four large turbines will drive 34,000-kw., three-phase, 60-cycle alternators which generate at 13,800 volts. The smaller machine will run a generator of 11,300 kw. capacity. The total capacity of the plant will be 147,000 kw., which may be raised to 181,000 kw. by the addition of a fifth large turbine. Transformers will step up the voltage from 13,800 to 66,000 for delivery to the transmission lines.

The water from the reservoirs will pour through passages in the Pinopolis Dam face and pass through scroll passages to the turbines. From the turbine draft tubes it will discharge into a tail canal at practically the level of tide in the Cooper River. Thus the full head of 75 feet in the reservoirs will fall on the turbines.

The navigation lock, through which barges and small craft will enter the Pinopolis Reservoir from the tail canal, is at the south end of the concrete section. The walls of the lock, which has a chamber 180 by 60 feet, are actually sections of the dam which hold back the full head of water. Steel miter gates close the ends.

The lower Santee River will be closed to navigation by the Santee Dam. By using



the lock lift, however, vessels will be able to cross the Pinopolis Reservoir and pass through the connecting canal to the Santee. They can then proceed to the headwaters of the Congaree and Wateree Rivers, which converge to form the Santee at the head of the reservoir. The project will thus recreate an abandoned canal system built in 1800.

# Annapolis Speeds Up

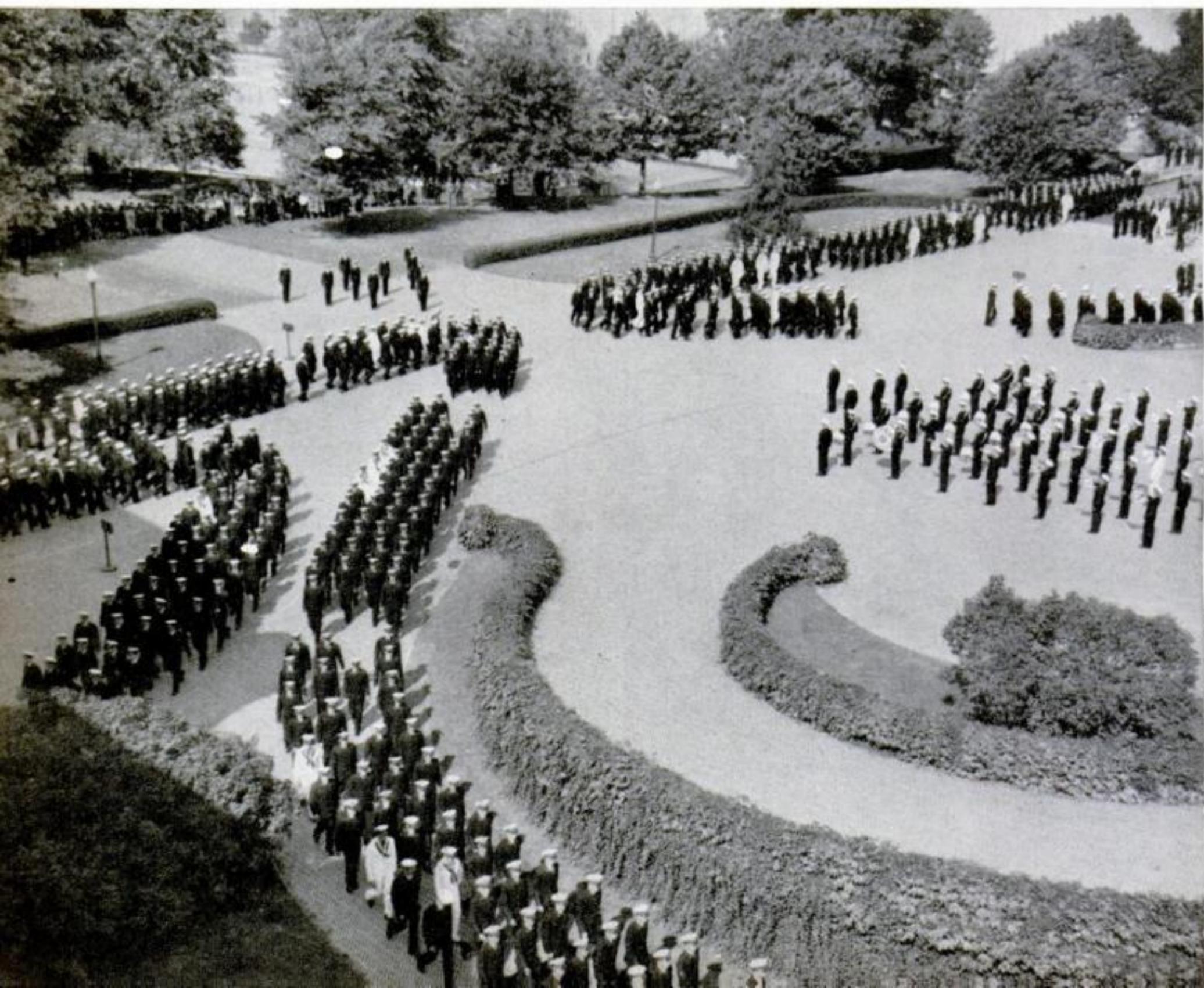
## TO TRAIN MORE OFFICERS FOR OUR BIGGER NAVY

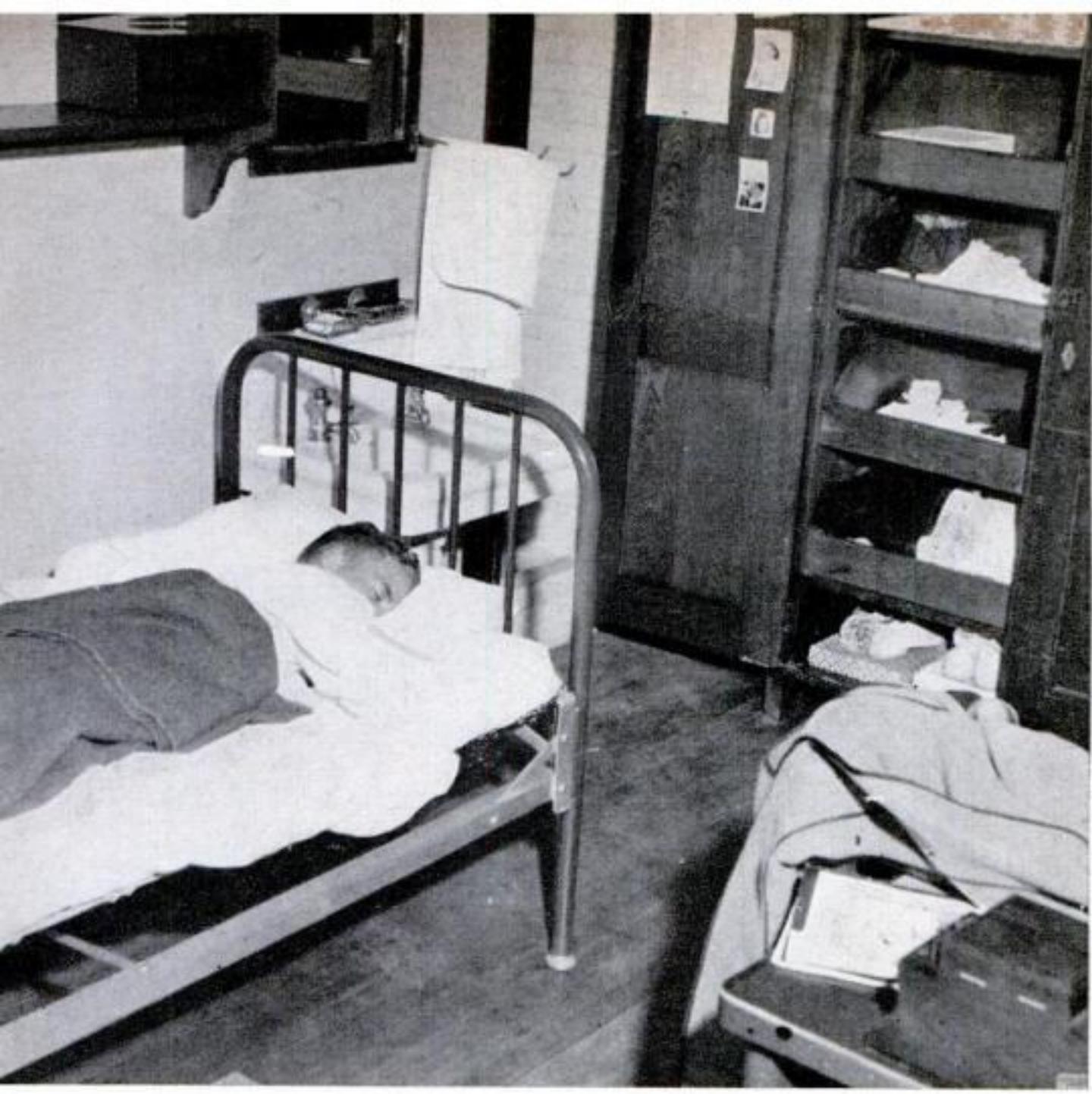
KEEPING pace with the production of new fighting ships in America's naval expansion program, Annapolis has instituted a twofold speed-up in the instruction of officers. Four years' training is being packed into three, and the Academy is accepting a larger number of eligible men than ever before. The 1,156 members of the current class of plebes, or freshmen—the largest in the 96-year history of the institution—have swelled the total number of midshipmen to about 3,100, or 800 above the 2,300 average of recent years. By 1944, of-

ficials expect Annapolis will be turning out between 650 and 700 trained ensigns annually.

In achieving this speed-up, the Academy has neither lowered the physical and mental requirements for entrance nor has it increased the length of the daily schedule. It is being accomplished by curtailing vacation time and by giving cultural subjects a minor role. Under the present program, 51 percent of a midshipman's course is devoted to mathematics and science, 22 percent to professional subjects such as navigation, sea-

Midshipmen marching into Bancroft Hall after noonday formation. Breakfast formation and inspection is held at 6:45 a.m., lunch formation at 12:20 p.m.; and dinner formation at 6:40 p.m. From breakfast formation until drill (3:25 to 4:30 p.m.) midshipmen must wear the blue service uniform with a white cap





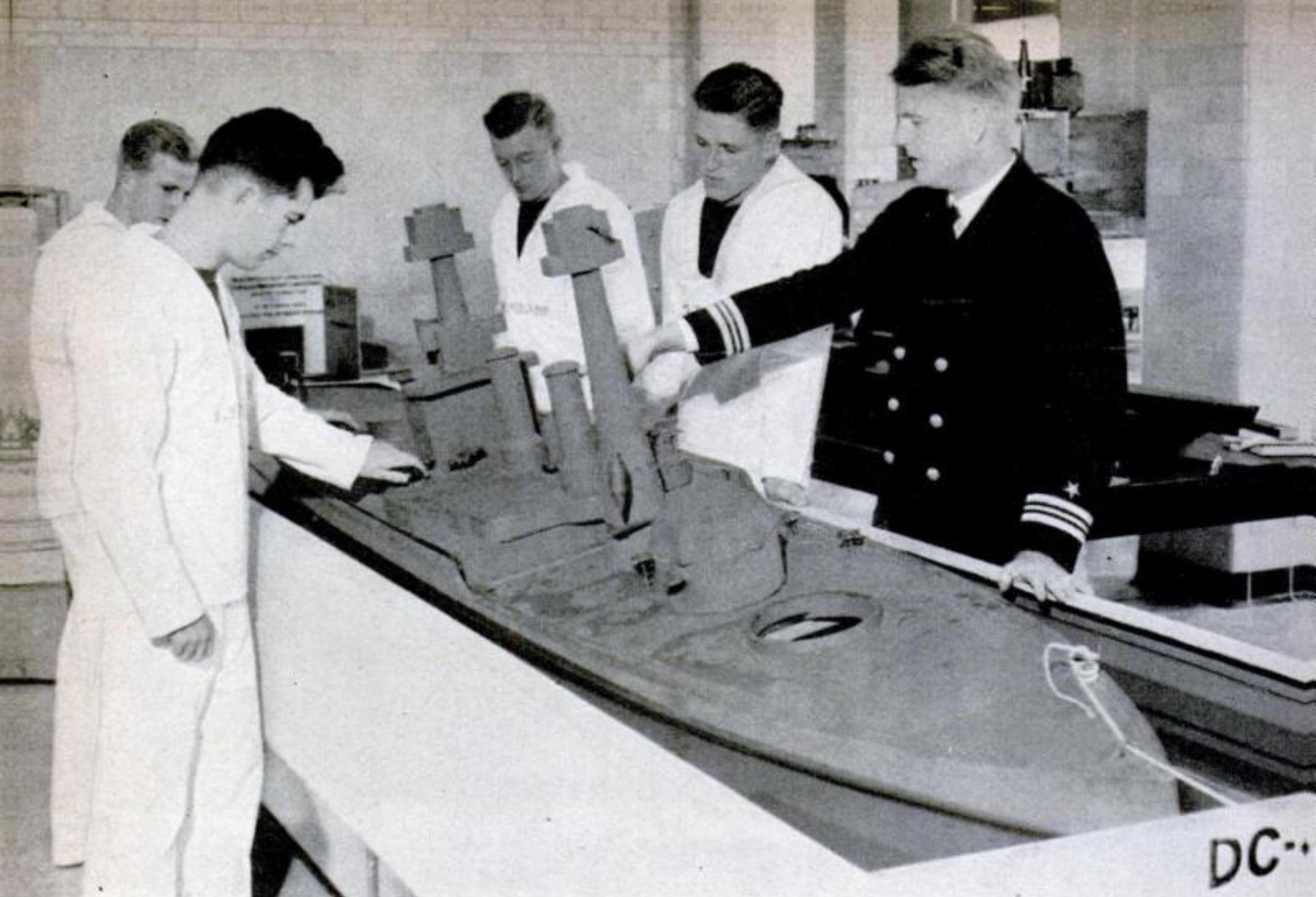
Not the cradle of the deep, but a bed in Bancroft Hall, the world's largest dormitory. Most rooms accommodate two men. When bugle and bell sound reveille, each man "hits the deck" and folds blankets and sheets over the head of his bed. A man from each room reports "All out, Sir" to inspectors in the hall

Plebes, or freshmen, returning from classes. They must walk in military manner in the center of the corridor and talk to nobody. Upperclassmen may walk at ease. At the right, a "youngster" (sophomore) is on duty as assistant mate of the deck. There are four recitation periods, the first beginning at 7:45 a.m., the last at 11:05 a.m.



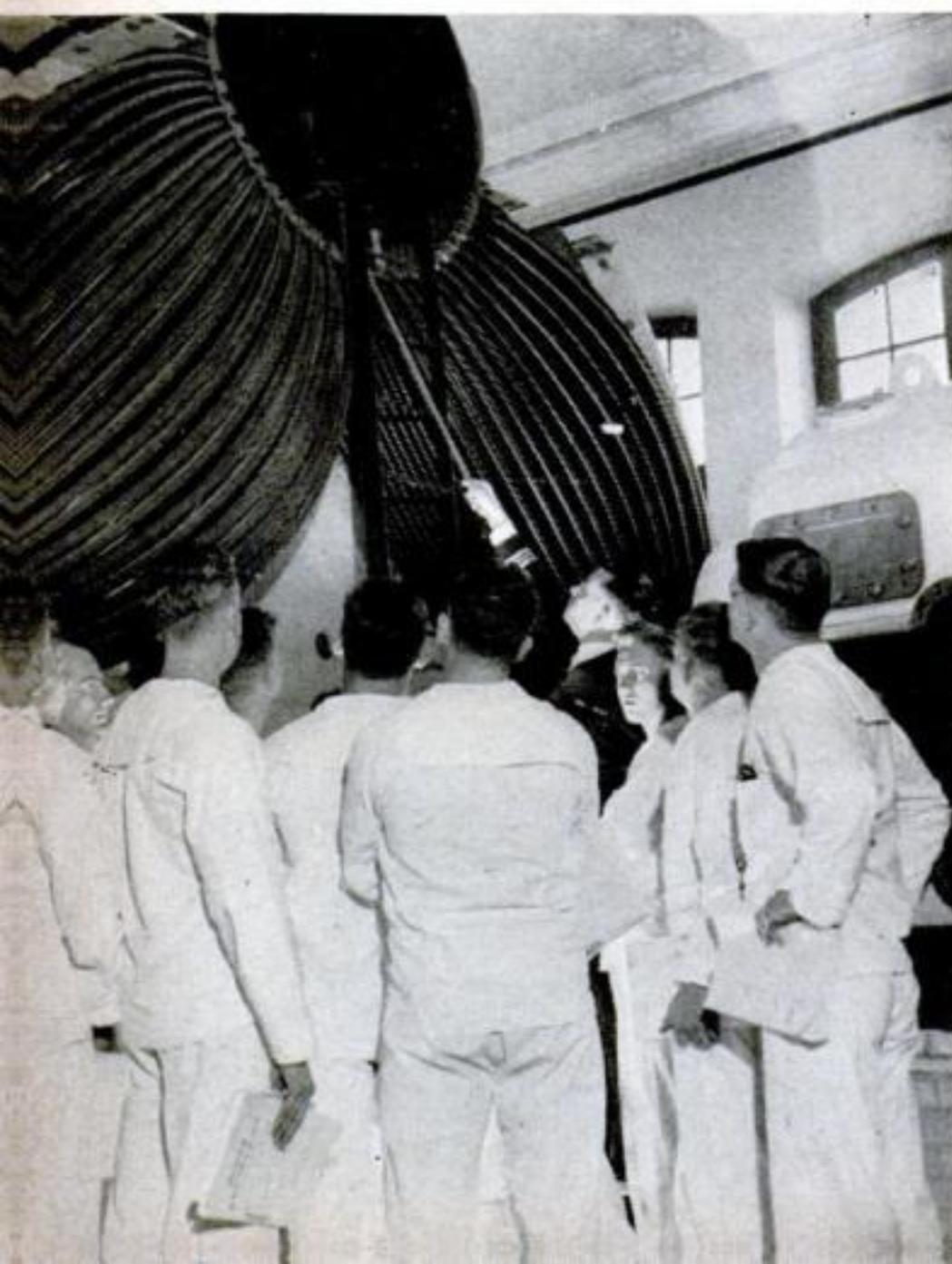
A bottleneck sometimes develops in front of a mirror just before reveille inspection. Twenty minutes are allowed for bathing, shaving, and dressing between reveille (6:20) and breakfast formation (6:45). On Sundays, midshipmen enjoy the luxury of sleeping until 7:15. After breakfast, they make their beds and tidy up their rooms





"P-work," or practical activities, supplements academic work. Here a lieutenant commander is instructing four first-classmen in the mysteries of "damage flood control." The effect of a shell or torpedo hit is simulated by flooding compartments of a model warship, and students figure out how to keep it in action

Below, an instructor explains the workings of a destroyer boiler that has been set up in the marine engineering laboratory at the Academy

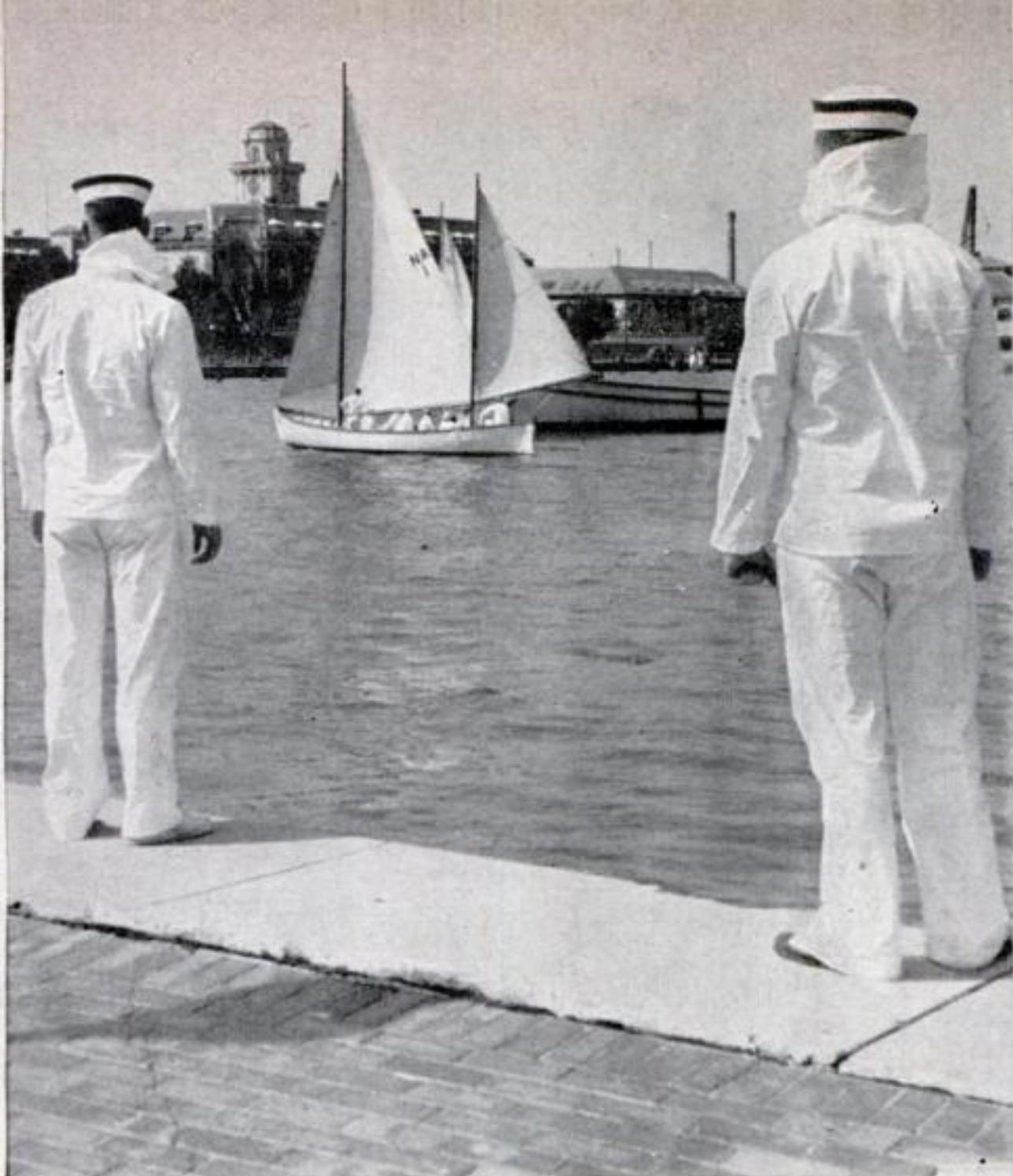


manship, gunnery, and ordnance, and 21 percent to cultural subjects.

The first result of the speed-up was the graduation of the Class of 1941 in December 1940 instead of June 1941. The Class of 1942 will be graduated in December 1941 and the Class of 1943 in June 1942. Thereafter, classes which have completed the four-year course in three years will be graduated each June.

To accommodate the greatly increased number of midshipmen, additional facilities, costing more than \$5,000,000, are being provided at the Academy. Bancroft Hall, where all midshipmen live and eat, is receiving two \$1,000,000 wings which will furnish 326 additional rooms. Other improvements include a new recitation building, additions to the power plant, a seaplane hangar, expansion of the Naval Hospital to provide 100 more beds, additional office space in the administration building and barracks for enlisted men on duty at the Academy.

Ordinarily, the four Naval Academy classes are known as plebe (freshman), youngster (sophomore), second class (junior), and first class (senior). Under the three-year plan, the second-class designa-



Naturally, our future admirals learn to be at home on the water. They practice at rowing and sailing boats in their drill period, and at the end of their first year they go on a practice cruise

tion probably will be discontinued. Plebes wear no sleeve stripes; youngsters wear one diagonal stripe; second-classmen two diagonal stripes; and first-classmen one narrow stripe around the sleeves. Last year, there were three companies in each of the four battalions of the Regiment of Midshipmen. This year, a battalion has five companies.

As in the past, most of the midshipmen are appointed by Congressmen, with about 25 a year receiving appointments from the President. Enlisted men in the Navy and Marine Corps are eligible for 100 appointments, filled by competitive examinations. Another 100 appointments a year are open to enlisted men of the Naval Reserve. Forty percent of all plebes entering the Academy are dropped, or "bilged," before graduation. Those who finish receive a B.S. degree and, usually, a commission as ensign.

In addition to its training of regular midshipmen, the Naval Academy this year gave a three-months' concentrated course for Naval Reserve midshipmen seeking line commissions in the V-7 class of the Reserve. Another three-months' course for 700 men will start in January, 1942. Candidates must have a college education and engineering graduates are especially desired. Similar concentrated courses at other institutions throughout the country are expected to raise the number of Reserve ensigns produced in this way to 5,000 a year. Another source of officer material is the Navy R. O. T. C. in 27 American universities. It is counted on to turn out an additional 1,350 Reserve ensigns a year when the program hits its stride.



Physical well-being is not overlooked, an afternoon period of two hours or more each day being devoted to athletics or other body-building activity. Here the gymnasium coach, C. W. Phillips, takes a reading as a lad tests his forearm flexors on a machine

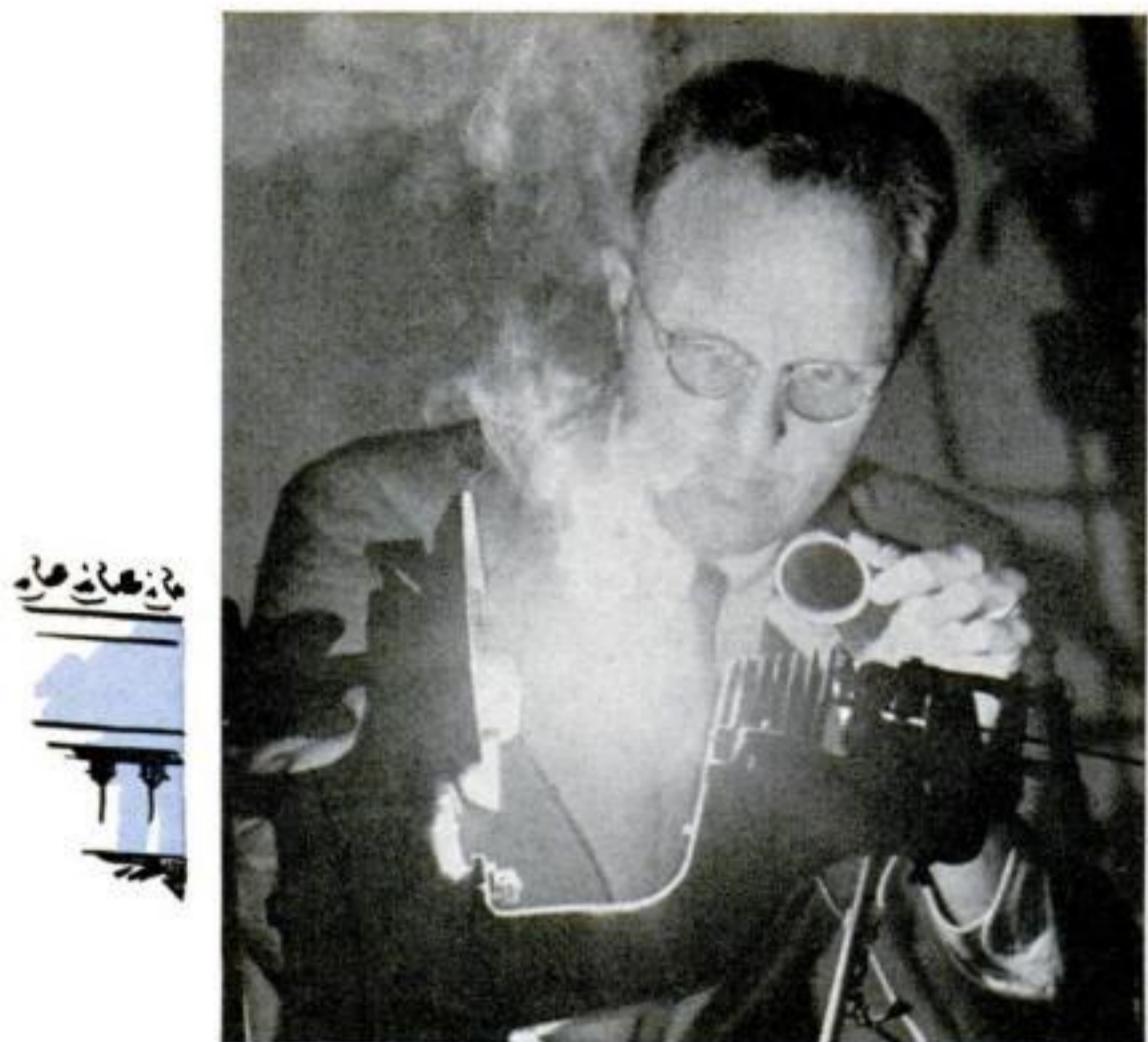


Dinner comes at 6:40 p.m. Note the "plebe position" held by the middy at lower right: shoulders held stiffly upright, four buttons of the blouse showing above the table. Hash is "deep see mystery"; pancakes, "collision mats"

After a relaxation period, about half an hour following dinner, comes study call. Tattoo sounds at 10; taps (lights out) at 10:05



# Here's



1 TODAY, DR. C. GUY SUITS IS ONE OF AMERICA'S LEADING RESEARCH SCIENTISTS. HE IS THE MAN WHO PRODUCED THE WORLD'S HOTTEST FLAME. TWENTY-ODD YEARS AGO, HE STARTED HIS FIRST JOB. IT WAS JERKING SODAS IN HIS FATHER'S DRUG STORE IN MEDFORD, WIS.



2 TO HELP PAY EXPENSES AT THE UNIVERSITY OF WISCONSIN, SUITS GAVE CLARINET LESSONS TO AS MANY AS 35 STUDENTS A WEEK. HE GRADUATED IN 1927, MAJORING IN PHYSICS AND MATHEMATICS



3 THE FOLLOWING YEAR, WHILE WORKING AT THE U.S. FOREST PRODUCTS LABORATORY, MADISON, WIS., HE INVENTED AN ELECTRICAL DEVICE FOR MEASURING THE MOISTURE CONTENT OF STORED WOOD



4 ON A SCHOLARSHIP TO THE INSTITUTE OF TECHNOLOGY, IN ZURICH, SUITS STUDIED IN SWITZERLAND IN 1929. TAKING UP SKIING, HE INVENTED A NEW METHOD OF REENFORCING THE EDGES OF SKIS

# My Story

## THE CAREER OF DR. C. GUY SUITS



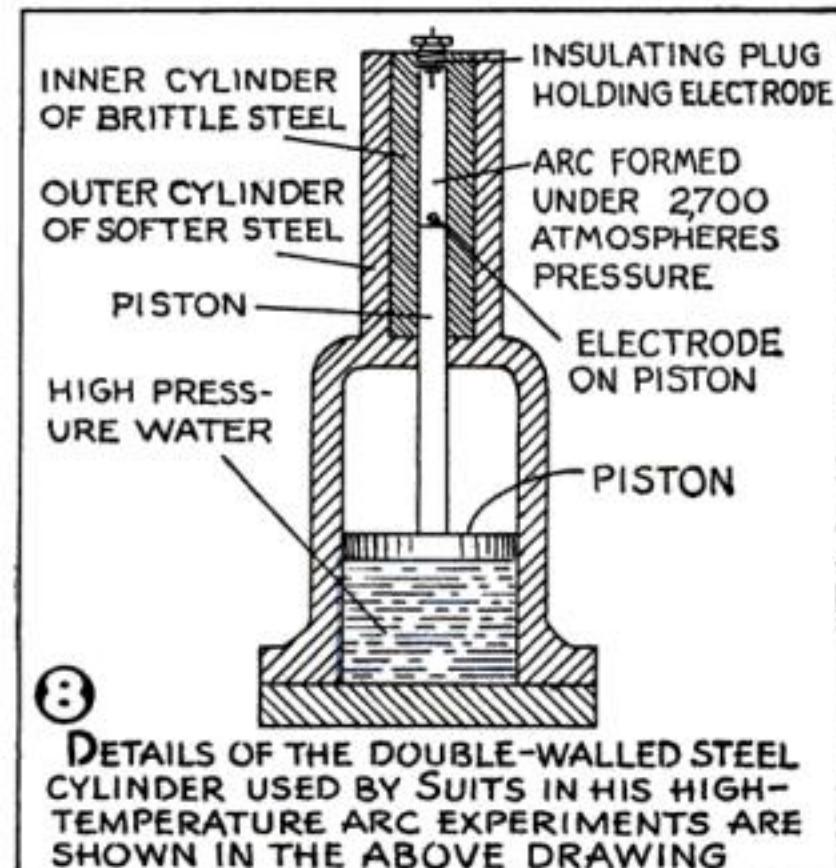
5 AFTER HIS RETURN, HE JOINED THE RESEARCH STAFF OF THE GENERAL ELECTRIC COMPANY, SPECIALIZING IN THE STUDY OF ELECTRIC ARCS



6 SUITS DEVELOPED A METHOD OF MEASURING THE HIGH TEMPERATURES OF ARCS BY PHOTOGRAPHING SOUND WAVES PASSING THROUGH LUMINESCENT GASES



7 EIGHTEEN THOUSAND DEGREES F.—MORE THAN TWICE THE TEMPERATURE OF THE SURFACE OF THE SUN—WAS ATTAINED BY SUITS WHILE EXPERIMENTING WITH AN ARC UNDER 2,700 ATMOSPHERES PRESSURE



8 DETAILS OF THE DOUBLE-WALLED STEEL CYLINDER USED BY SUITS IN HIS HIGH-TEMPERATURE ARC EXPERIMENTS ARE SHOWN IN THE ABOVE DRAWING



9 LAST YEAR, AT 35, DR. SUITS BECAME ASSISTANT DIRECTOR OF THE GENERAL ELECTRIC LABORATORY. HIS MORE THAN 50 PATENTS COVER INVENTIONS IN THE FIELD OF RAILWAYS, RADIO, WELDING, AND SUBMARINES



Socks worn over the shoes deaden scuffling sounds in dancing scenes and walking scenes. Here Bernard Brown, sound chief at Universal, fits them on Maria Montez



Even the big sets are sound-deadened by installing walls made of canvas, which are painted realistically with water colors

## Manufacturing Quiet for the Movies



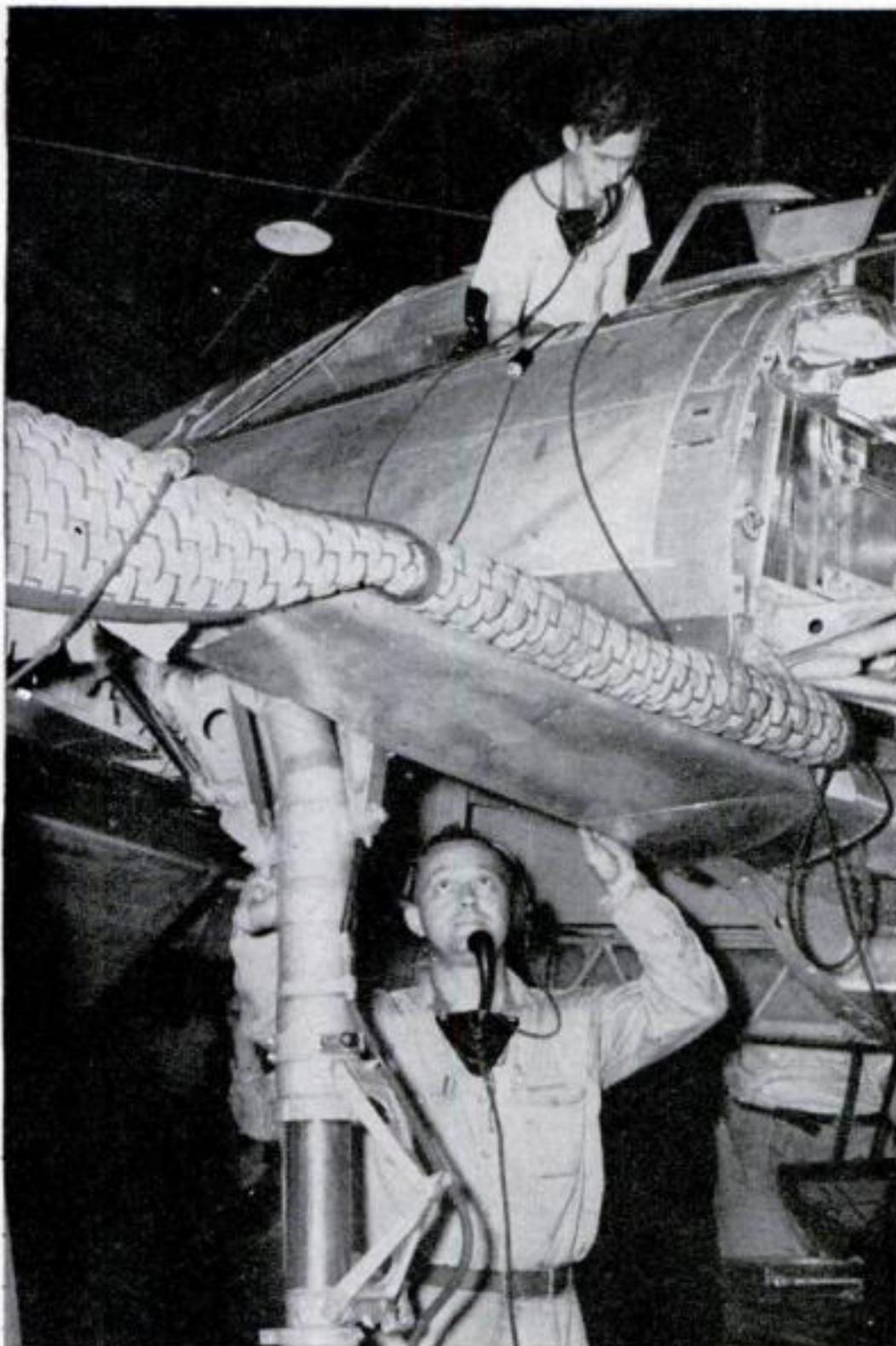
Giving a skirt an audition. Dresses are all tested for sound; in close-ups, silk is replaced by celanese taffeta. Old Man Microphone catches everything, and his sensitive ear seems specially attuned to a real silken rustle. Thus, the silkworm's product is banned in any close-up in which silence is golden

SILK is not silk on a Hollywood sound stage, gravel is not gravel, cement is not cement, grass is not grass, carpets are not wool, walls are not wood, and a singer doesn't sing. These are among the deceptions developed by the industry to kill stray noises. A tour of Universal Studio by a Popular Science cameraman disclosed the latest tricks of the sound experts. Silk gives off a disturbing rustle, so actresses wear celanese taffeta, and even then their dresses are sound-tested. In dancing and indoor scenes where dialogue must be heard clearly, socks are worn over shoes. Gravel walks are made of chipped and dyed cork to kill the crunch of actors' feet. Cement walks are simulated by soft building board, and artificial fiber grass replaces real grass. Burlap walls are substituted for wood to eliminate reverberation. Grass pads absorb the drip of fake rain. A singer records his or her voice in a soundproof booth, the music being dubbed into the picture later by synchronization. Before the camera the scene is shot silent, as in the old days.

Cement isn't cement, and grass isn't grass. These workmen are laying soft building board in squares to represent a concrete walk, and placing artificial fiber grass to simulate a grassy lawn border



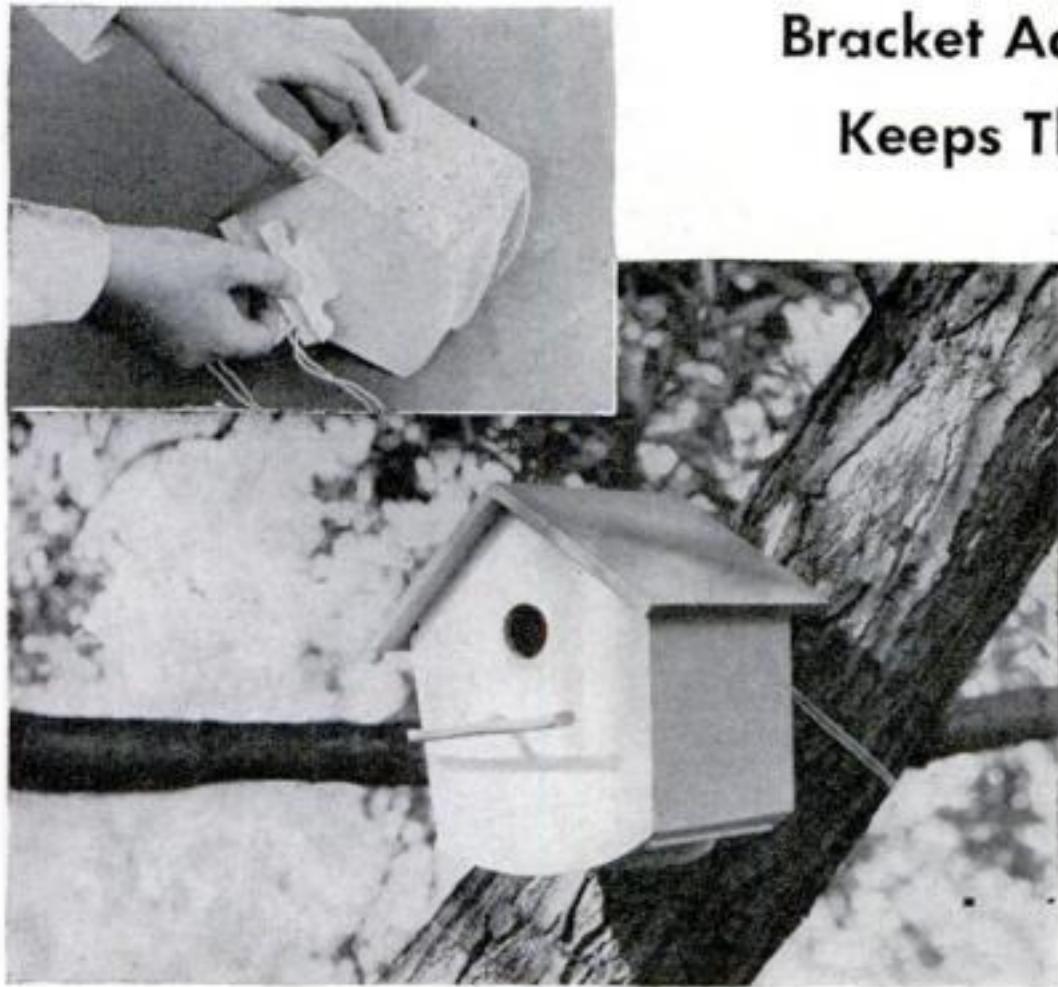
# Portable Phones Save Time for Aircraft Workers



TELEPHONES are being used to speed airplane production, but not in the way you would suspect. In the Republic Aviation Corporation's plant at Farmingdale, N.Y., assembly-line workers use them for communication between men inside fuselages and those outside. Before the telephones were put into use, it often took several minutes for instructions to be transmitted to men working inside the planes. The noise of the factory and the metal shell surrounding them made it impossible for the inside workers to hear even shouted orders, and another workman had to crawl inside the plane to carry the message.

Now, however, such messages are transmitted in a matter of seconds. Inside and outside workers wear telephones like those used by switchboard operators—lightweight headphones held in place with a spring clamp and transmitters strapped to their chests. This type of equipment leaves their hands free to continue work even when they are engaged in conversation. Almost any number of phones may be hooked into a single circuit. No figures are available yet on time saved by the use of phones, but it has been estimated that in a month it will amount to enough to build a complete plane.

## Bracket Adjusted to Angle of Limb Keeps This Bird House Upright



TO MAKE the bird house shown at the left easy to mount in an upright position regardless of the angle of the branch to which it is to be fastened, it is fitted with an adjustable bracket which can be twisted to any desired position. The house, which is built for wrens and has an entrance too small to allow sparrows to enter, is designed to be fastened in place with cord, thus eliminating the need for tools when putting it up. By tarring or varnishing the cord to protect it from the weather, this type of fastening can be made to last a long time.

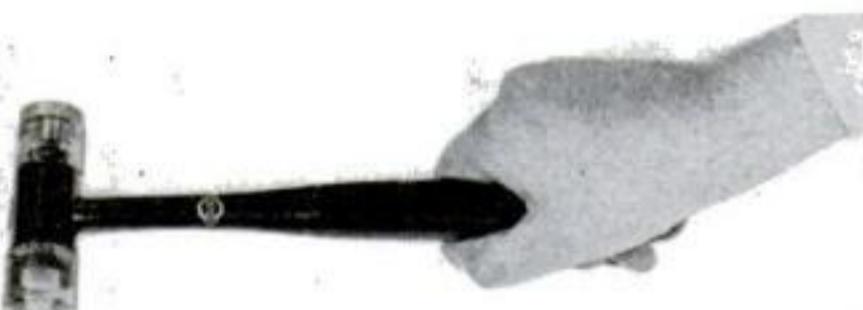
# DO YOU KNOW YOUR HAMMERS?

IF YOU call any one of the ten tools pictured below a hammer, you are absolutely right. But what kind of a hammer? For there are almost as many kinds as there are trades and crafts.

Illustrated are an upholsterer's hammer,

nail hammer, engineer's hammer, jeweler's (or hobbyist's) hammer, machinist's hammer, riveting hammer, machinist's soft-face hammer, body worker's (metalworker's) hammer, chisel-edge claw hammer, and boiler inspector's hammer.

Try to write the correct name under each, and check your results with the list below—printed upside down to remove temptation.



1 .....



2 .....



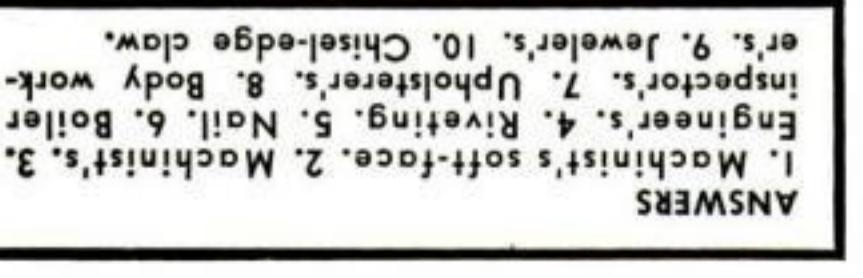
3 .....



4 .....

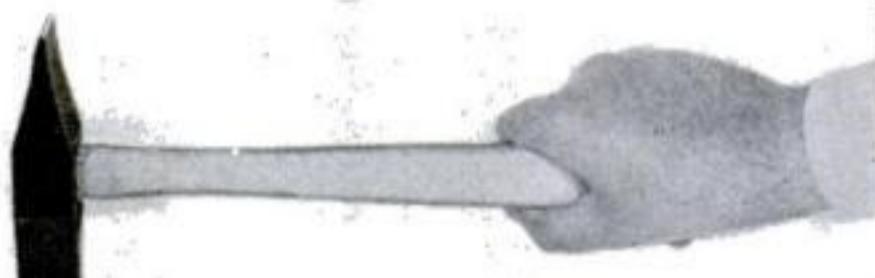


5 .....



ANSWERS

1. Machinist's soft-face. 2. Machinist's. 3. Engineer's. 4. Riveting. 5. Nail. 6. Boiler inspector's. 7. Upholsterer's. 8. Body worker's. 9. Jeweler's. 10. Chisel-edge claw.



6 .....



7 .....



8 .....



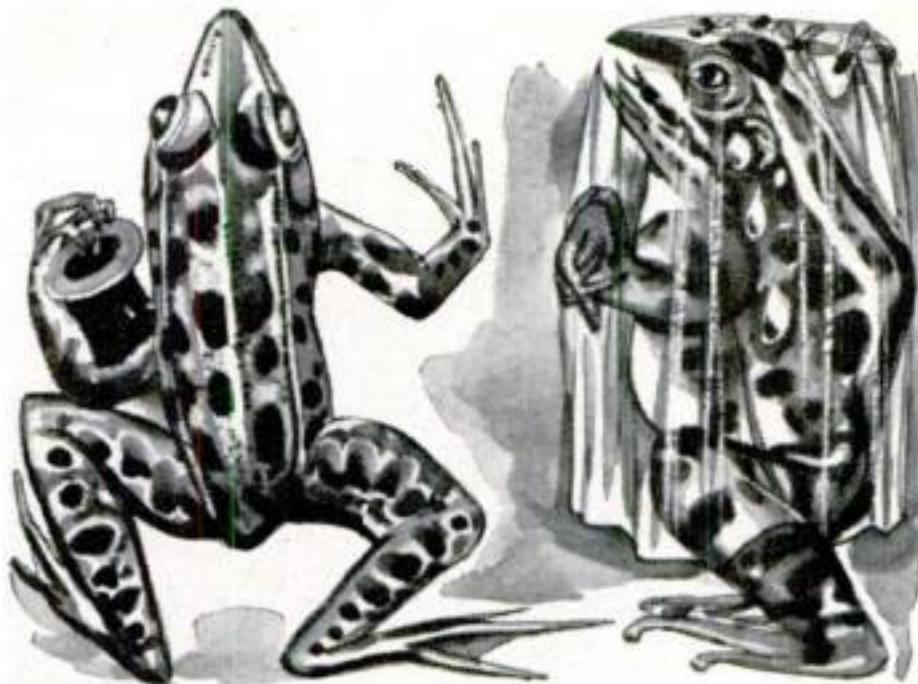
9 .....



10 .....

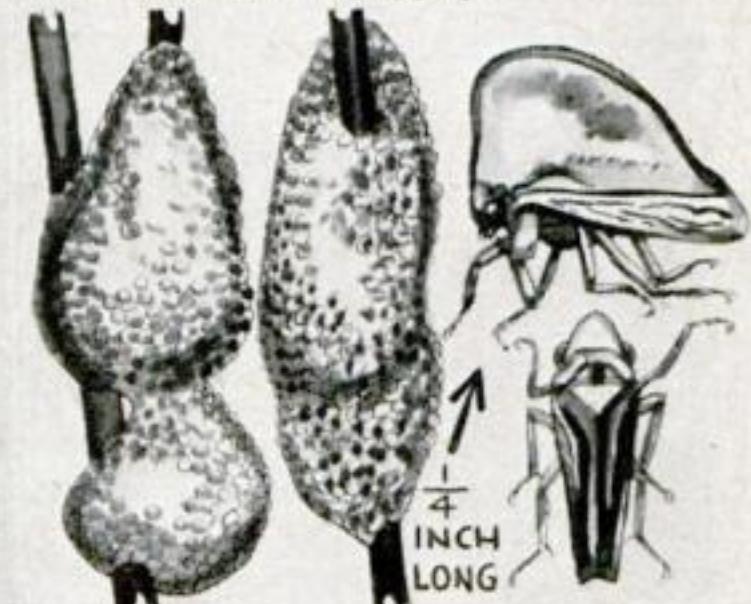
# Un-Natural History

BY  
*Gus Mager*

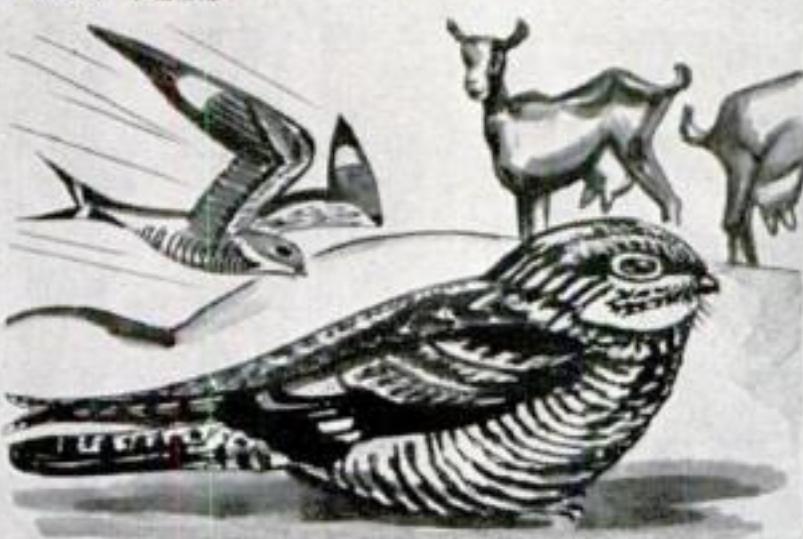


FROGS MAY LOOK ALIKE TO YOU, BUT THEY DON'T TO OTHER FROGS. SOUTHERN LEOPARD FROGS ARE SO SNOOTY THAT THEY REFUSE TO MATE WITH ORDINARY LEOPARD FROGS EVEN THOUGH THEY LIVE IN THE SAME POOL!

THOSE BUNDLES OF BUBBLES THAT CLING TO WEED STEMS ARE NOT CUCKOO SPIT, AS THEY ARE OFTEN CALLED. THEY ARE MADE BY FROGHOPPERS, OR SPITTLE INSECTS, AS NESTS IN WHICH TO LIVE UNTIL THEIR WINGS DEVELOP!

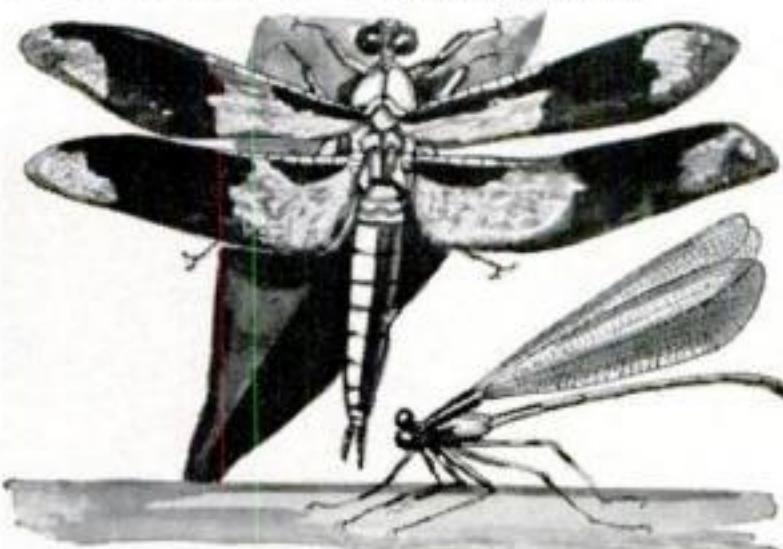


NIGHTHAWKS ARE NOT HAWKS AT ALL, BUT GOATSUCKERS. TO MAKE IT MORE COMPLICATED, THEY DO NOT MILK GOATS, THOUGH LEGEND SAYS THEY DO. THEY OFTEN FLY NEAR THESE ANIMALS IN SEARCH OF INSECTS ON WHICH THEY FEED



MILK SNAKES ARE THE SUBJECT OF ANOTHER FALLACIOUS LEGEND ABOUT MILK. THEY FREQUENT STABLES AND DAIRIES IN SEARCH OF MICE AND RATS, BUT DO NOT DRINK MILK. THEY DON'T EVEN DRINK MUCH WATER!

MOST DRAGON FLIES REST WITH THEIR WINGS SPREAD OUT FLAT. BUT DAMSEL FLIES, ONE OF THE SAME SPECIES, FOLD THEIR WINGS OVER THEIR BACKS, JUST TO BE DIFFERENT!



IF YOU THINK FISH AREN'T TOUGH, TACKLE A GAR FISH SOMETIME. BIG ONES, SOMETIMES WEIGHING SEVERAL HUNDRED POUNDS, HAVE SCALES SO HARD THAT THEY CAN'T BE PIERCED WITH AN AXE!

# Can America Build

**WE NEED 4,000 OF THEM  
TO TAKE CARE OF OUR  
EXPANDING AIR FORCES**

By P. O'MALLEY

**H**OW many airports is enough? America needs between 3,500 and 4,000, according to the Civil Aeronautics Administration, which has planned the nation's airport-construction program. This program was presented to Congress in March, 1939, and was based on expansion of civil and commercial aviation anticipated at that time. The war crisis has since forced the emphasis to be removed from civilian flying and concentrated on military aviation. As a result, changes in the design and placing of the airports have been made, but, according to the C.A.A., the total number needed still remains the same.

Can we produce them?

We can, and more if necessary. The need is for coöperation between the Federal and local governments in allotting funds, sites, and materials. Congress appropriated 40 million dollars last fall to get the program under way. Eighty million more was added in July to continue the work. Many more millions will be needed if the program is to be completed as outlined.

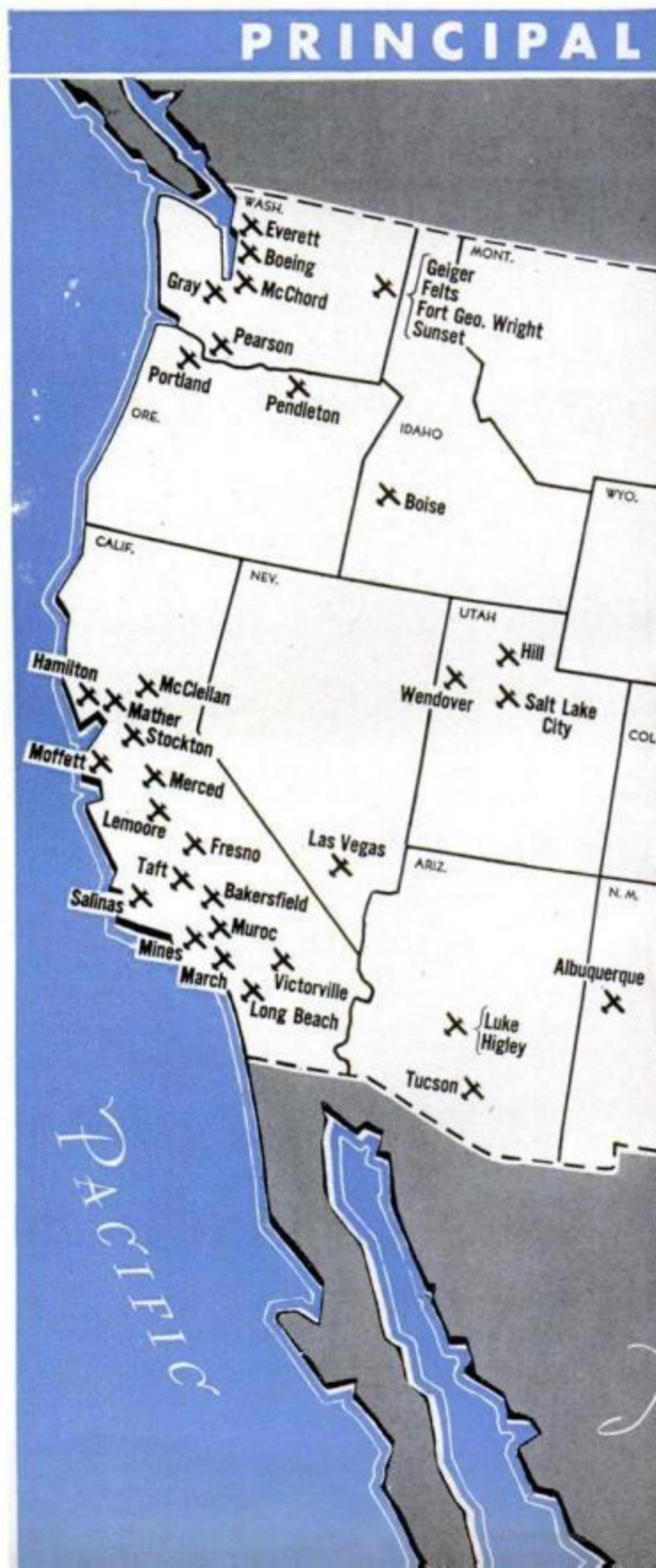
Are we producing them?

Yes, and speedily. When the C.A.A. got its first appropriation a year ago, 200 airport projects were started. Nearly \$19,000,000 of the second appropriation is being used to complete 113 of these airports. The rest is going toward a string of 288 new ones around the perimeter of the United States. Military airports are most needed along the Atlantic, Gulf, and Pacific coasts, which must be defended strategically and because of their industrial concentrations.

In New England, for example, including New York, a total of 55 projects costing

\$14,259,670 have been started. In other Atlantic Coast areas an additional \$15,286,000 will be spent. For work along the Gulf of Mexico \$12,950,000 is allotted and along the Pacific Coast, \$8,006,000.

Small, self-contained cities are actually springing up around the country as these C.A.A. projects and the vast flying fields being built by the Army take shape. The larger airports, in addition to actual landing, storage, and repair facilities for aircraft,



Army air fields dot the map as the defense program gets into full swing. Those shown are the most important ones at present, but even as this map was being made ground for more and more fields was being broken. In many cases the Army shares facilities at municipal or commercial fields, and coöperates with local private aviation activities.

# Enough Airports?

must provide their own power, heating, sewerage, and water services. They must include barracks, hospitals, warehouses, recreation facilities, and even miles of roads and railroad spurs.

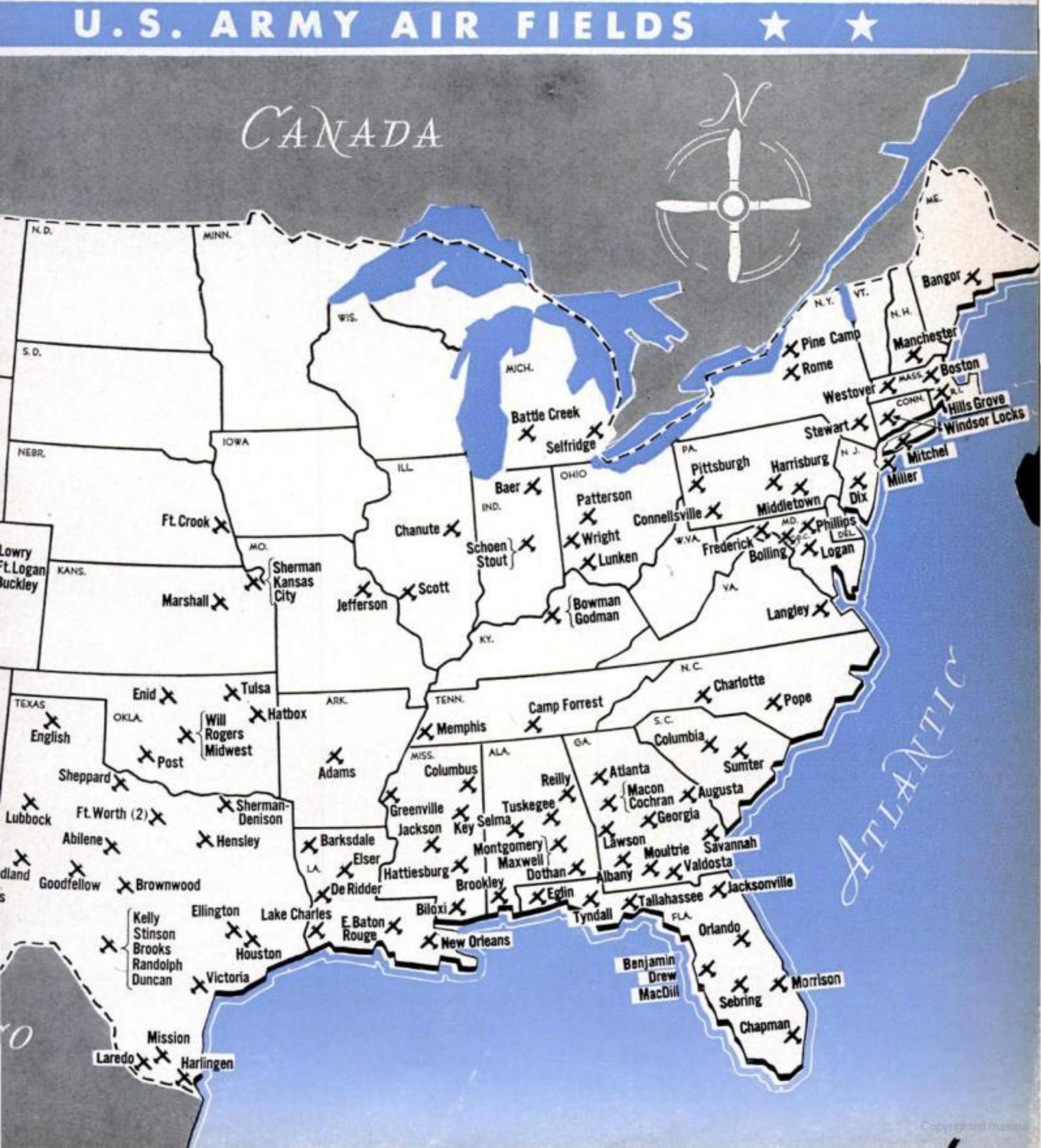
The C.A.A., realizing that America has never taken advantage of its waterways for aviation, is also speeding a program to develop seaplane bases, on lakes and rivers as well as along the coasts. Seaplane bases have many advantages. They cost less to

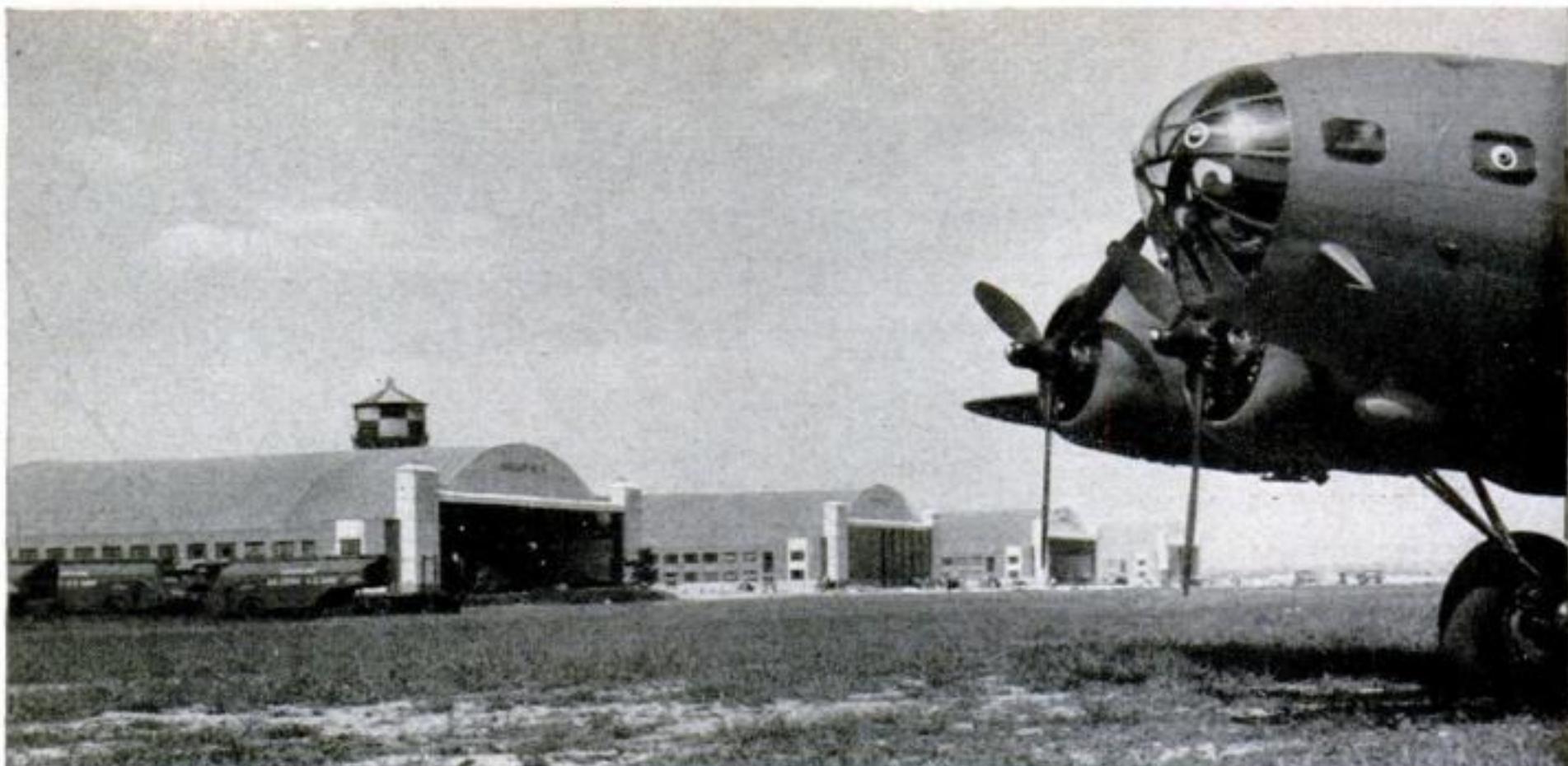
develop and maintain than airports. Airports can be destroyed by bombs. Water landing areas cannot.

The C.A.A. embarked in the Spring of 1939 on a plan to install seaplane docks on a national scale. The National Youth Administration built the bases to C.A.A. specifications with materials furnished by local communities. Already more than 200 have been completed.

Another recent development which may

# U. S. ARMY AIR FIELDS





From tobacco fields to airport: Westover Field at Chicopee Falls, Mass., is one of the Army's newest

prove to be important to the nation's airport program is the construction of flight strips along federal highways. The first real test of flight strips was projected by Congress in the emergency road bill. The idea was developed by the Army for emergency military landings and as possible points for scattering combat planes in case of attack. Now leaders of civilian flying have become interested, visualizing the use of flight strips for commercial projects and as centers of aviation activity in rural areas. Rent of hangar space would boost farmers' incomes.

The airport program may also be aided by another new idea which promises to reduce the cost of airport construction. That is the use of soil cement for runways. First tried on country roads, soil cement is a method of stabilizing ordinary earth.

The method is simple. The earth is scarified and pulverized with harrows to a depth of six inches. A thin layer of cement is spread over the surface and mixed with the soil. Then water is added with a pressure distributor. The surface is then rolled, covered with a thin bituminous wearing surface and left to dry under straw. It costs about \$1 a square yard, half the cost of concrete. Soil cement is now being tested at the Fort Wayne, Ind., airport. If it proves it can take it, the way will be opened to use soil cement on hundreds of other projects.

It is still too soon to tell how much effect these developments may have on the airport program. But to understand what is going on now in the program it is necessary to know something of how airports have been built in the past in the United States.

Until the C.A.A. got its first appropriation last fall, the Federal Government had con-

sidered that the building of civilian airports was the responsibility of local communities. The C.A.A. had for years been advising municipalities to plan and build systems of airports just as they do park systems. Had this been done, civil aviation would not now be on the spot because of the occupation of so many airports by the Army and Navy.

The failure to heed the C.A.A.'s advice is proving serious in the present emergency, but the blame can not be heaped on the shoulders of city fathers alone. When the aviation bubble first drifted across the national horizon many local governments, in the carefree rapture of the middle twenties, floated long-term bonds and bought up fields for airports. Not much was known about the airport business then, so most of the fields lost money. With the arrival of the

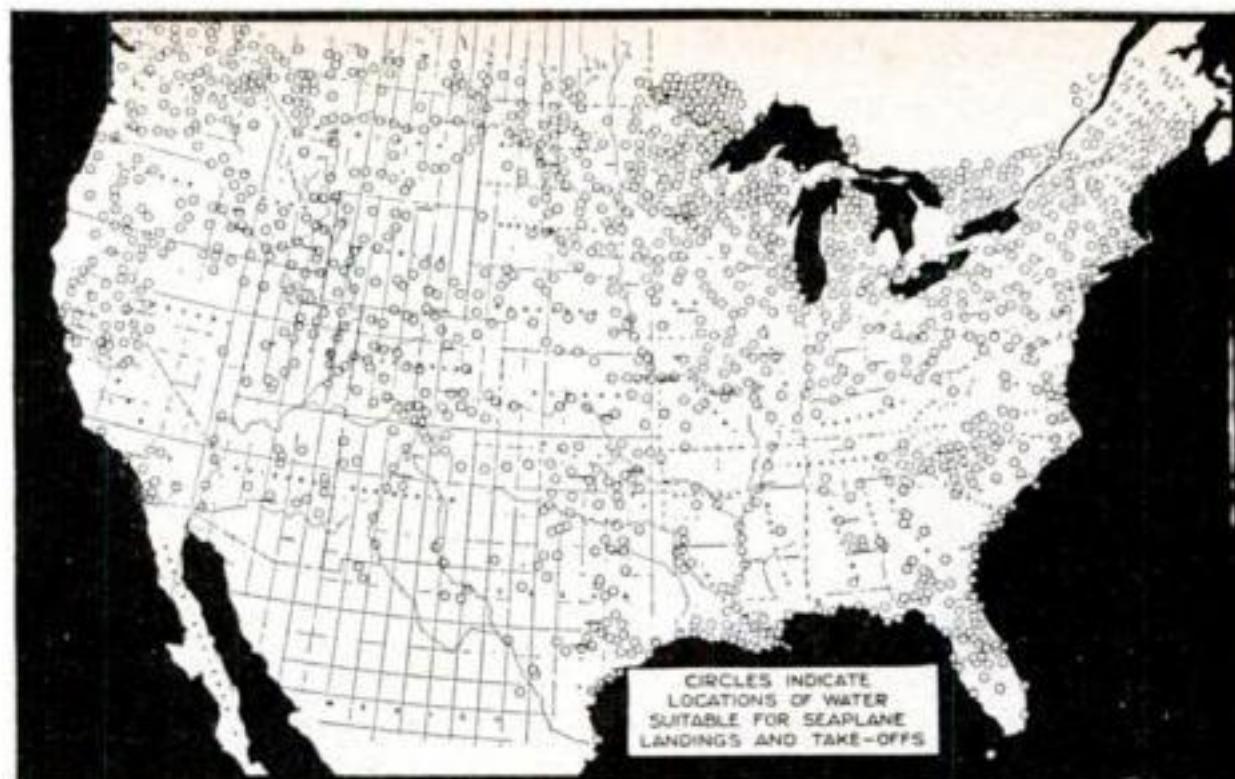


Breaking ground for a military flying field means just that. A lot of dirt has to be moved in grading the long, broad runways and laying down roads

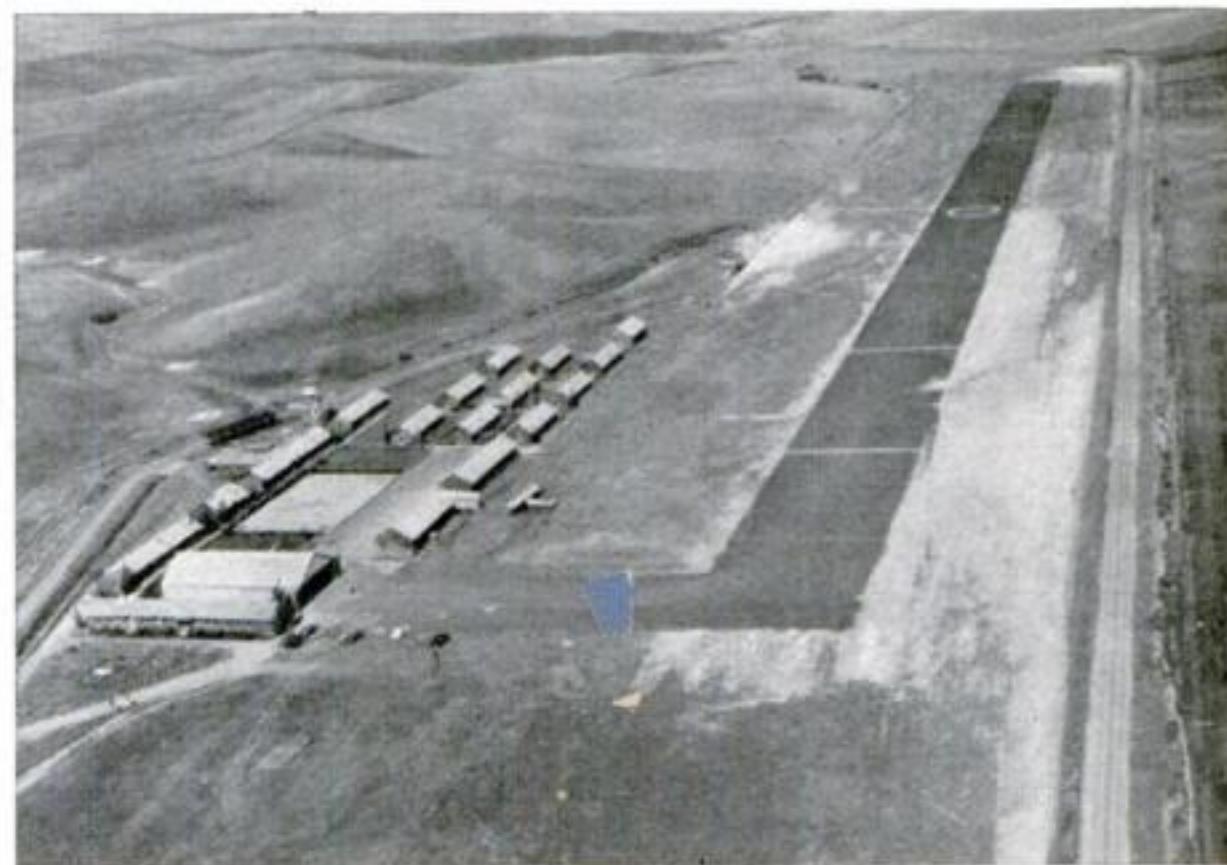
depression they became white elephants.

But the depression also brought federal work relief and public works projects. One of the most obvious places to dump some of these public funds was in airport construction. Some exceedingly valuable facilities were built in this way. By the end of 1941 about \$371,000,000 will have been spent for airports through F.E.R.A., C.W.A., P.W.A., and W.P.A. projects. Now, in the defense emergency, they are beginning to pay dividends.

Only when the war clouds began to blow toward America did the Federal Government decide to give the C.A.A. funds for airports. Because of the limited funds made available, it was imperative to get the most for the least. Hence it was decided that not one C.A.A. penny could be spent for land or buildings. This leaves the responsibility on local communities to provide the sites, erect the buildings, and maintain and operate the fields. The C.A.A. supplies only actual landing facilities such as runways and lights. But local governments, including cities, counties,



Water landings for seaplanes are being developed by a Government program which provides for building docking floats and fuel stations



"Flight strips" alongside highways would provide emergency landing fields. Hangar space for local flyers would give farmers a new crop

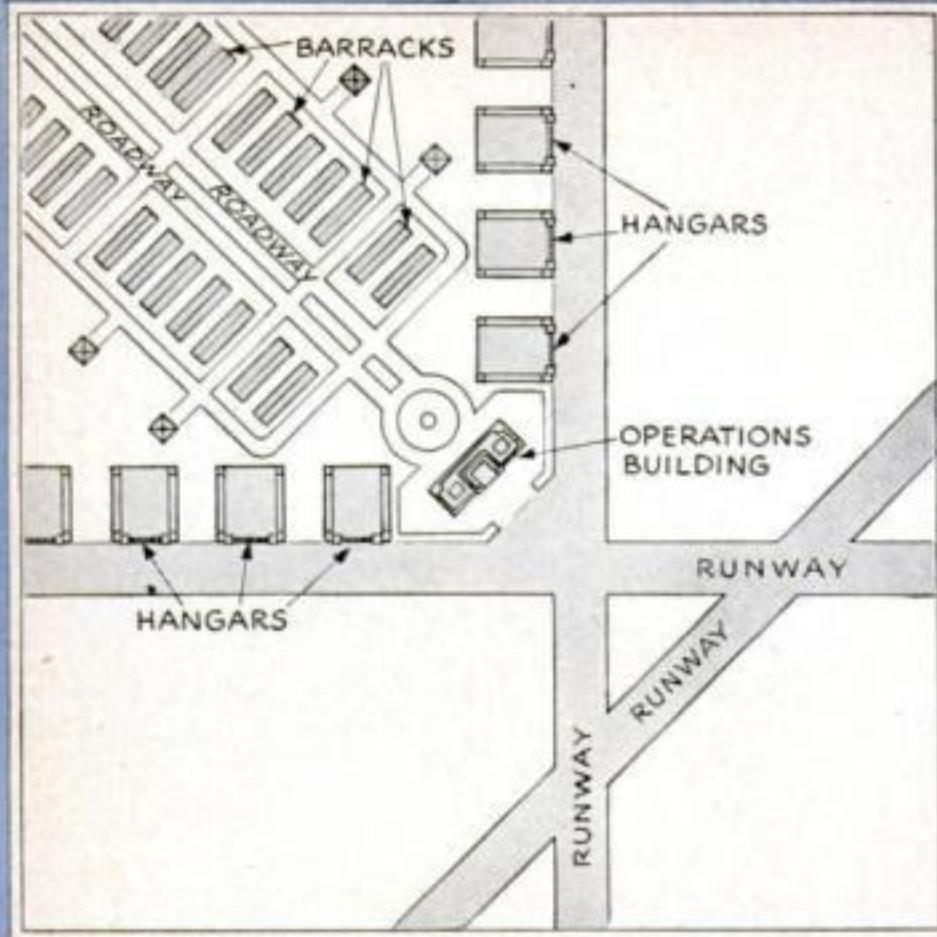


Sometimes it is necessary to strip off loose dirt and sand on the airport area, replace it with topsoil, and plant grass to stop blowing



Landscaping the grounds around barracks and other buildings is a big job. Much of the work is designed to be permanent for use after the defense emergency

# THE MODERN MILITARY AIRPORT IS A LITTLE CITY IN ITSELF



This is a typical plan of an Army field, showing arrangement of the runways, hangars, and buildings

## WHAT IT TAKES TO MAKE A BIG ARMY AIR FIELD

Flight hangars	Paint and dope bldg.
Concrete hangar aprons	Photo laboratory
Paved runways	Supply warehouses
Communications bldg.	Barracks
Officers' quarters	Mess halls
Fueling systems	Guardhouse
Incinerator	Post office
Central heating plant	Motor repair shops
Water system	Vehicle garage
Electric system	Chapel
Sewage system and treatment plant	Theater and school
Steam pipe system	Parachute drying bldg.
Communications system	Operations bldg.
Roads and railroads	Recreation bldg.
Radio buildings	Officers' club
Magazine area	Link training bldg.
	Hospital unit

**HOSPITAL.** Provision is made to take care of the health of the thousands of men who will be stationed at the large fields

and states, are falling in line with this plan and the C.A.A.'s long-range program is going ahead to create a network of airports keyed to tomorrow's needs.

And what are tomorrow's needs? For the immediate future they are predominantly military. For the future that may be in store when the fury of the war has burned out, they will be civil and commercial. But civilian needs may be infinitely greater as an aftermath of the present military expansions.

Tremendous new airplane factories, some of them among the largest industrial plants in the world, are now rising. Thousands of skilled mechanics are being trained and employed in aircraft production. Imagine the rate at which these plants and men may some day be able to turn out small training, private



**DARKROOM** facilities are provided for developing photographs made in aerial mapping

**ROADS**—as much as 12 miles of them in a large field, are graded and paved . . .



and commercial airplanes! Price reductions will accompany such quantity production, provided of course that a market is available.

By the beginning of 1942 the Army, Navy, and C.A.A. will be turning out pilots at the rate of 100,000 a year. These pilots, together with those who will continue to learn to fly at their own expense, promise to provide such a market to keep aircraft production at a high peak after the war.

If this happens, and many believe it will, we must be certain that the airport system being built for national defense can be salvaged and converted easily to civilian and commercial uses. Aviation experts say that, with a few relatively simple changes, it can.



**HANGARS.** With more than an acre of floor space, this brick-and-concrete building will house eight big four-motor bombers. Its sliding doors are opened in 2½ minutes by electric motors



**PHOTOGRAPHIC LABORATORY** includes not only darkrooms but also facilities for storage and repair of aerial cameras



**BARRACKS** are provided for enlisted men and officers. Other structures include mess halls, administration buildings, recreation halls, theaters, post exchanges, chapels

.... and lines must be laid for sewers, water supply, gas, electricity, communications

**DENTIST'S OFFICE** is a busy place. Health of flying and ground personnel is an important factor in air-force efficiency



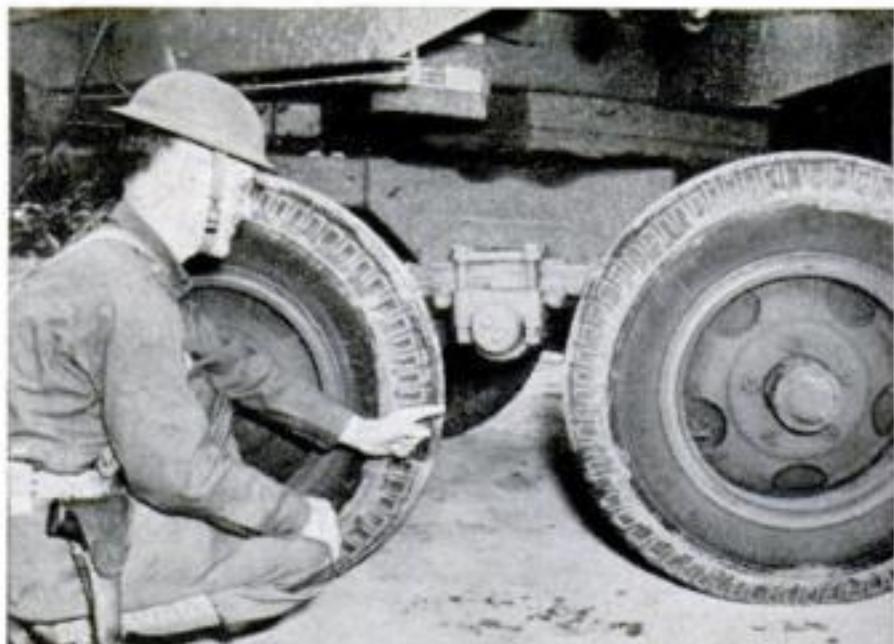
## Troop Transport Truck and Trailer Go Almost Anywhere



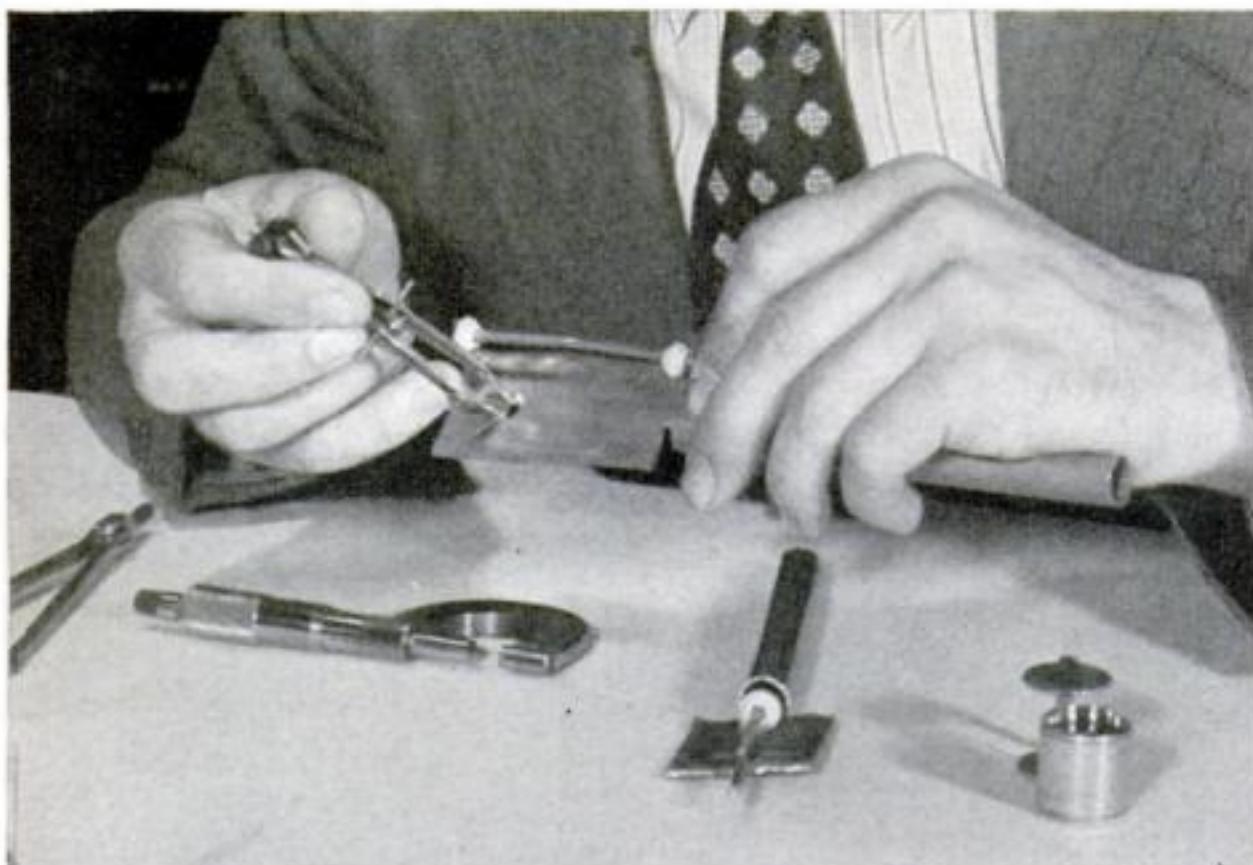
Seventy-five soldiers of the 32nd Infantry, 4th Army, are riding in this rough-terrain 2½-ton truck and its trailer. All wheels follow tracks of the truck's front wheels

An officer points out "arc-ticulated" axle which permits these trailers to roll over rough country. Each axle is independent, permitting wheels in line to stay in track

**A** NEW U. S. Army troop-transport trailer permits the movement of large bodies of troops over difficult terrain. It was made possible through a type of axle known as "arc-ticulated," developed at Fort Ord, Calif., under the direction of Maj. Gen. Joseph W. Stillwell. The axle permits each wheel of the trailer to follow the same track as the front wheel of the truck, making it possible for the unit to pick its way over difficult places. A truck and trailer can carry 75 men, or 65 with ammunition, food, and supplies for three days in the field.



## Lightning is "Fingerprinted" to Identify Kinds of Bolts



Measuring the amount of metal melted by lightning that struck a wireless tower cable. This imprint will be compared with those made in laboratory

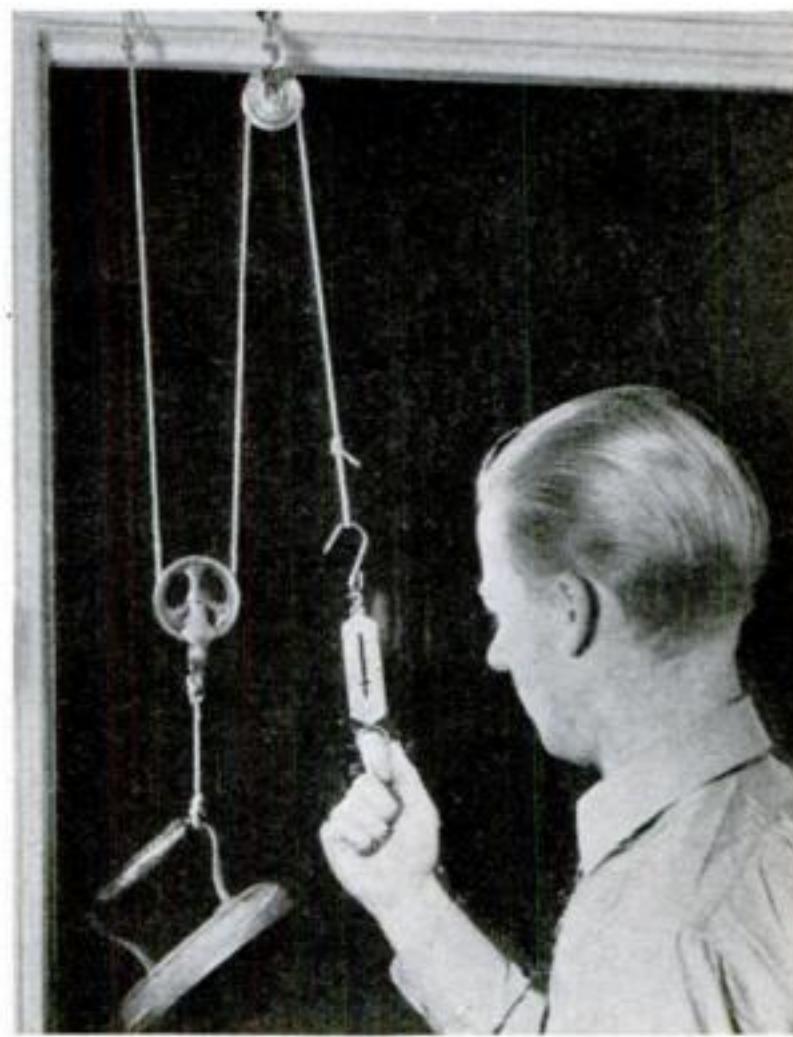
"FINGERPRINTS" left by lightning on metal objects it strikes provide clews to its nature and help design protective devices. At the Western Electric and Manufacturing Company's laboratory at Sharon, Pa., a file of several hundred "fingerprints" has been collected by bombarding lightning rods, power-line conductors, and telephone wires with man-made lightning. The scars left vary with the type of lightning used, and these scars are compared, by means of microscope and caliper, with scars left by natural lightning.

# SCIENCE STUNTS

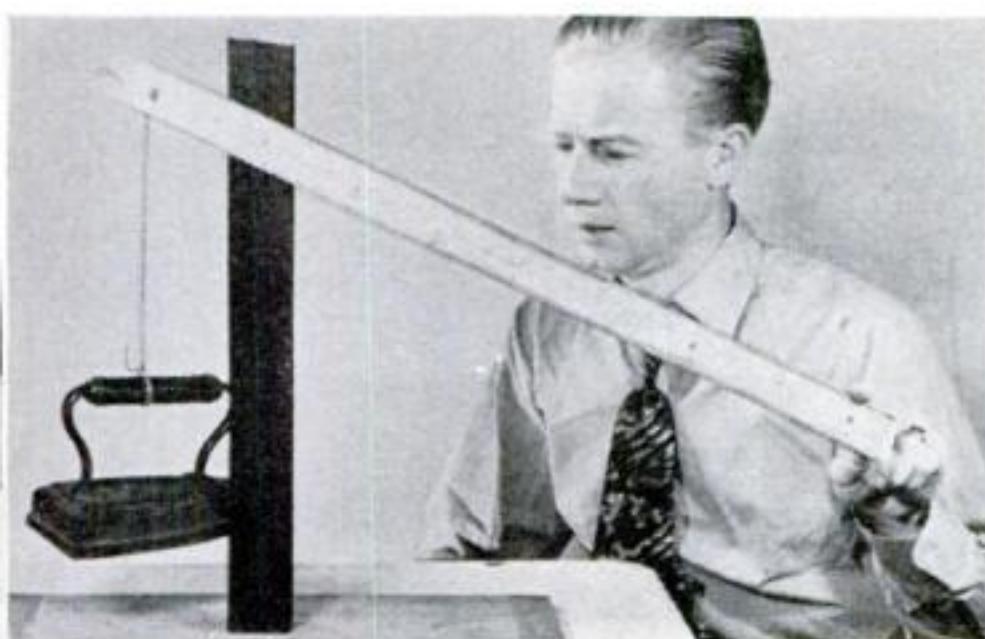
## SIMPLE EXPERIMENTS SHOW PRINCIPLES OF ALL MACHINERY

TO PERFORM tasks beyond their strength, and to shorten light but time-consuming work, men long ago invented a few simple machines. Today practically every sort of hand or power mechanism—even as complex as a car or a printing press—consists largely of a combination of those same fundamental devices. Experiments on this and the following page enable an amateur scientist to demonstrate their action.

**ROPE AND PULLEYS.** In the picture at right, the lower, movable pulley halves the effort required to raise an eight-pound iron. The spring scale registers only four pounds. Above, a fixed pulley does not reduce the needed force, but conveniently changes its direction. The "mechanical advantage," or multiplication of force, is 2; additional pulleys would increase this ratio, as in a block and tackle. Slower lifting of the weight is the price paid for this advantage.



**COMPRESSED-AIR PUMP.** In many homes without city water supply or a high water tank, pressure is maintained by compressing air in part of a water storage tank. To demonstrate this application of an old principle, attach long and short glass tubing through a two-hole stopper to a flask of colored water. Pinch the rubber connection of the long tube, and, by blowing into the short one, force about a dozen air bubbles into the flask. Then close the connection to the short tube, open that of the long one, and the water will be forced up the latter by the air pressure in the flask.

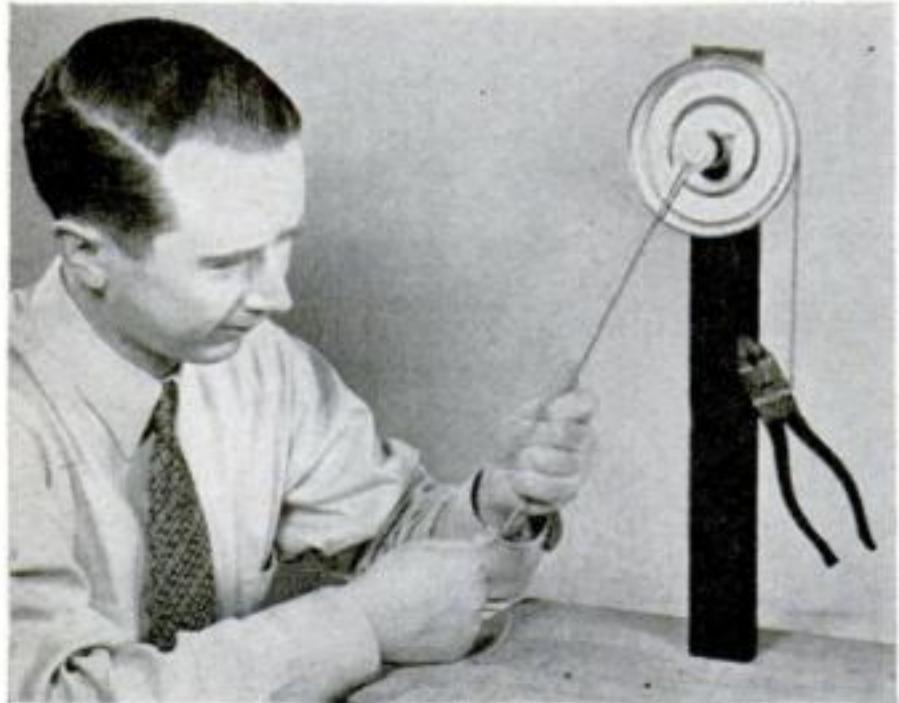


**LEVERS.** A fingertip's touch on the long end of a pivoted bar, at left, easily lifts a heavy iron hung from the short end. Here is one of many forms of the versatile lever, perhaps first used to pry up boulders and move heavy logs. Crowbars, pump handles, nut-crackers, and pliers illustrate levers used to multiply force; paper shears and lazy-tong devices represent levers used for lengthening range of movement, when increase of effort is too slight to matter. Comparative distance of load and applied force from the pivot or fulcrum determine exactly what the mechanical advantage will be.

**INCLINED PLANE.** Barrels and drums, too heavy to lift bodily, may be loaded on a truck by rolling them up a slanting plank. At right, the principle is shown with a toy auto weighted to two pounds, and drawn with a spring scale up an inclined plane two feet long with a six-inch rise. The scale will register half a pound (plus a small amount for overcoming friction). Neglecting friction, the mechanical advantage of an inclined plane is directly proportional to its length, for a given height.



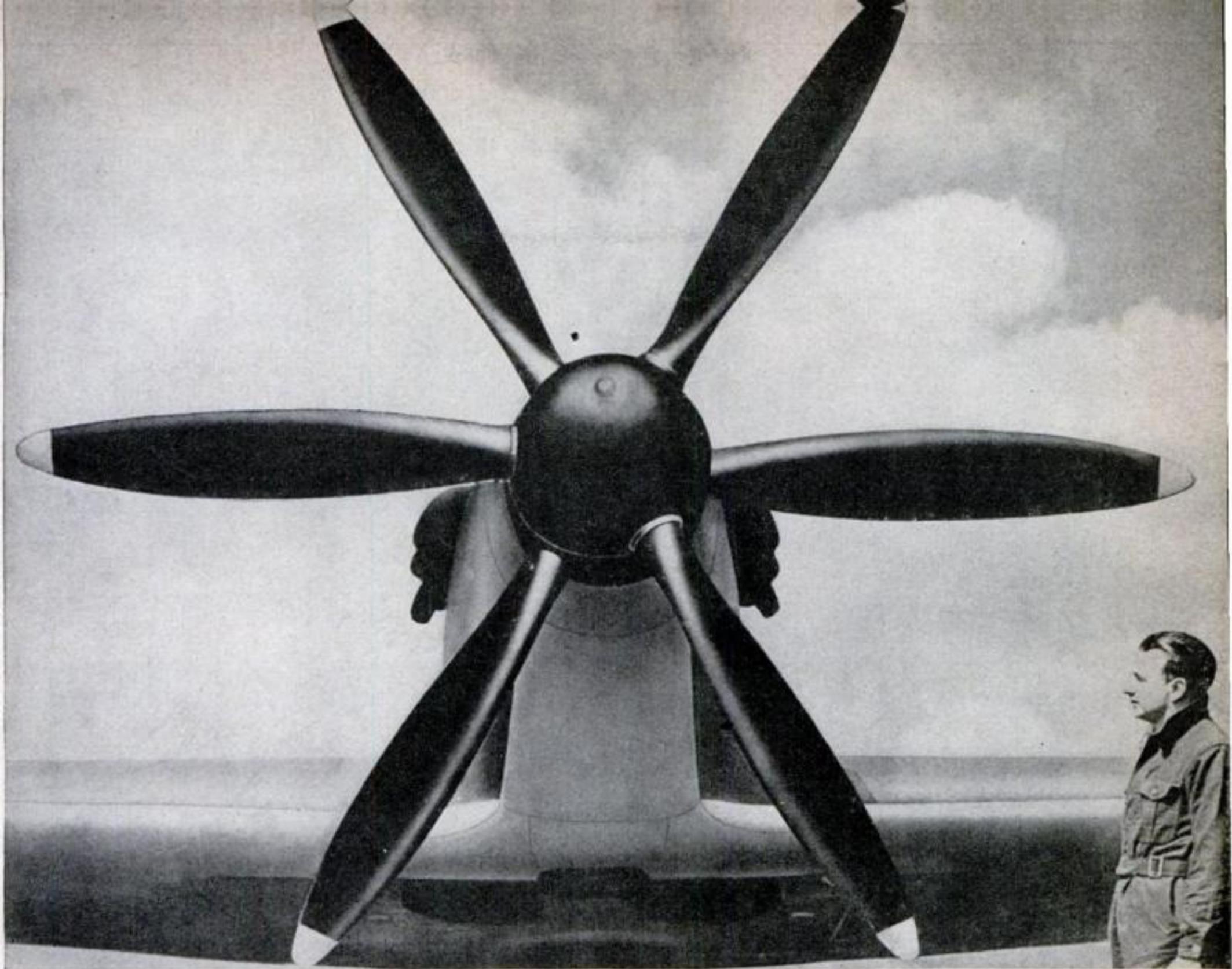
**WHEEL AND AXLE.** Steering wheels and windlasses exemplify this modified sort of lever. Turning a large wheel exerts strong force on an axle or smaller wheel; conversely, as pictured, a strong effort on the smaller member is needed to lift a weight by the larger one. Drive belts and gear trains are wheel-and-axle forms with the driving and driven members on different shafts, instead of the same one.



**THE SCREW.** Fundamentally, a screw thread is merely an inclined plane wrapped around a cylinder or cone. The force with which a wood screw pulls together a pair of boards shows the usefulness of this simple machine. Turn a screw by means of an extension bar, as in a jack-screw or letter press, and the result is a tremendous mechanical advantage. The pull of one finger, on a cord wrapped around the seat of a piano stool, suffices to raise the formidable load illustrated. In this case the principle of the screw is combined with that of the wheel and axle, described below.

**THE WEDGE.** Applied in axes, chisels, knives, and pins, this is simply a movable inclined plane. Light taps on a wooden wedge, as pictured below, raise a platform supporting a man's weight. Heavy machinery similarly is lifted into place. But because of its considerable friction, resulting in wasted effort, a machine designer would prefer levers or other movements of equal mechanical advantage.





A British test installation of the contra-prop system. Two 3-blade propellers turn in opposite directions

## Two Propellers in Tandem Turning in Opposite Ways Give Warplanes New Speed

**T**WIN PROPELLERS, whirling in opposite directions on concentric shafts, are an expected innovation on at least five experimental warplanes of 1942. Current reports indicate that all leading U. S. propeller makers are making the "contra-prop" air-screws, and that they will boost cruising speeds, to say nothing of maximum speeds, well above the 400-mile-an-hour mark.

An Italian racing plane first used the tandem-propeller system 12 years ago. Since then, various designers have toyed with the idea. But its large-scale adoption has awaited present demand for motors of 2,000 horsepower and upward.

"When horsepower increases," explains Robert J. Woods, designer of the Bell Airacobra pursuit craft, "the plane requires either a longer prop or more blades. Twelve

feet is pretty much the limit for prop diameter, and more than four blades on a propeller interfere with each other. So the next thing for the engineer to do is to get two propellers." In addition, he points out, the normal tendency of a single propeller to tip the craft is counterbalanced by the opposite rotation of the second one in the tandem arrangement. Contra-prop installations may be made not only on conventional plane types but also on "pusher" designs with the propellers behind the engine.

The diagram below shows how the two props counterbalance each other's rotation and so remove the tendency of the plane to tip and turn to one side

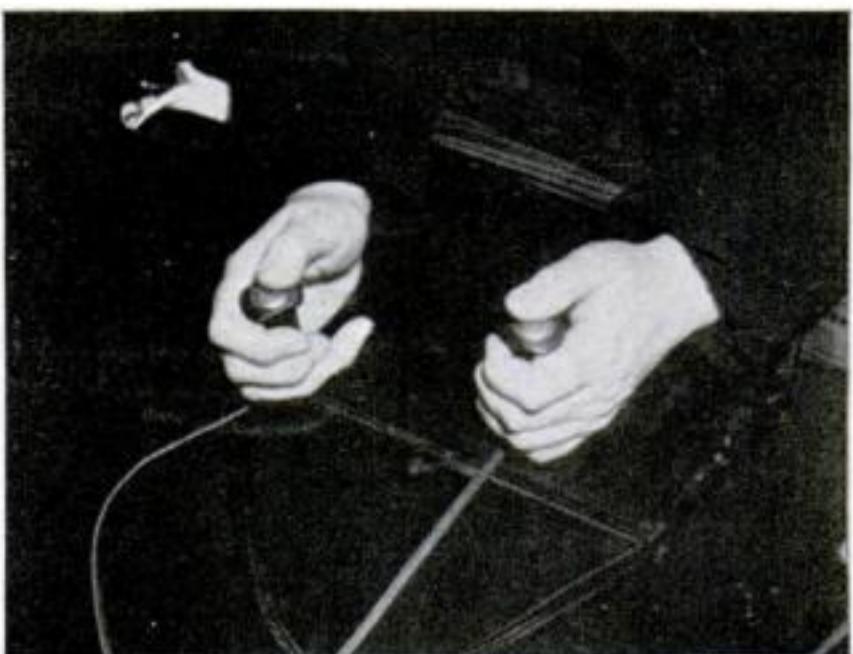


## Program Analyzer Supplies Record of Audience's Reactions

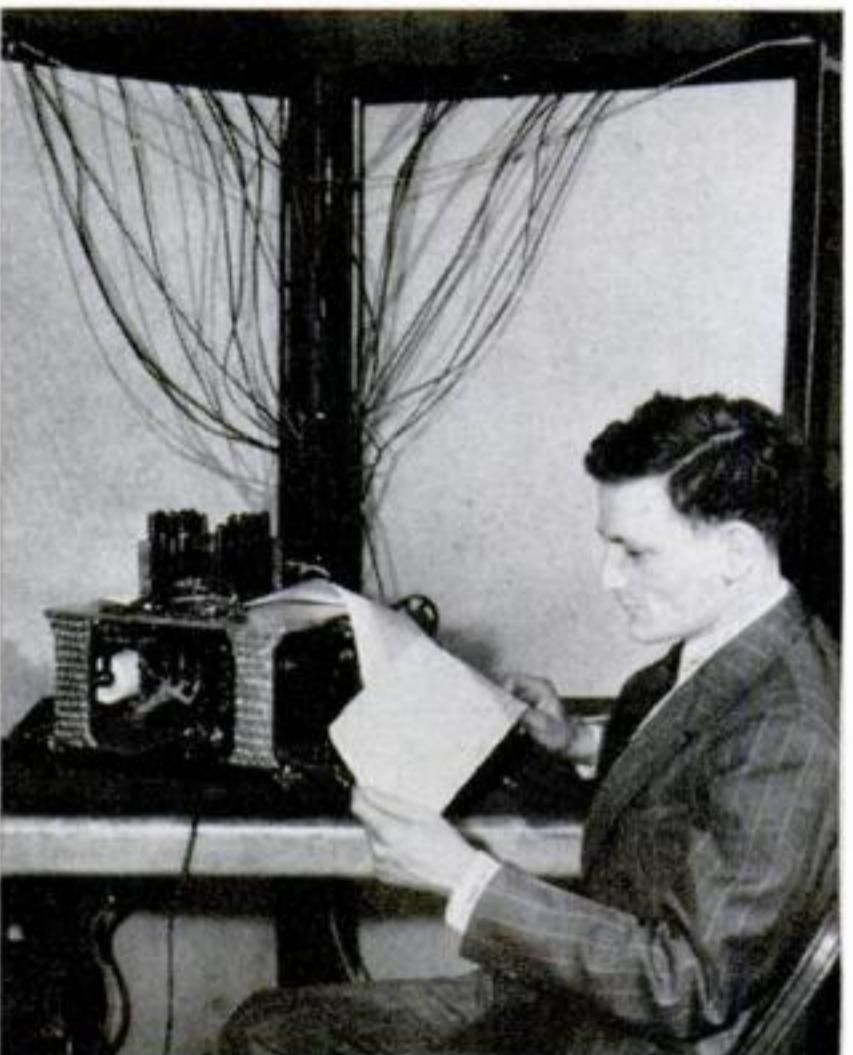


Each member of a test audience receives red and green reaction buttons and instructions on how to use them

HOW audiences like radio programs is determined by a program analyzer developed by Dr. Paul Felix Lazarsfeld, of Columbia University, and Dr. Frank Stanton, of the Columbia Broadcasting Company. To each of a selected studio audience a pair of buttons is given, one for each hand, one green, and one red. When a person likes the program, he presses the green button; when he doesn't like it, he presses the red; if he is neutral, he presses neither. Each pressing and releasing is recorded on a moving tape to provide a continuous record of reactions.

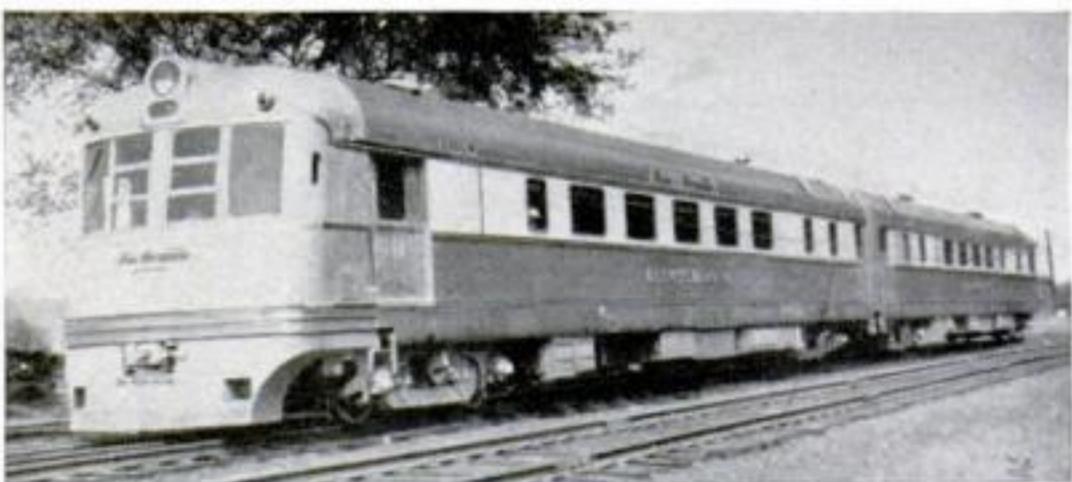


Pressure on the green button, above, means the program is going over; on the red, that it isn't. A continuous record of reactions is transferred to tape by the machine below



## Two-Car Diesel-Propelled Train Provides Full-Length Luxury

LUXURY of a full-length train is found in the two-car, Diesel-powered "Prospectors" of the Denver & Rio Grande Western Railroad. Sixty-two passengers are accommodated, with reclining coach seats for 44 in the first car and berths for 18 with dinette, dressing rooms, and observation lounge in the second.



# ARMY'S SMOKE THROWERS

## SCREEN TROOP MOVEMENTS



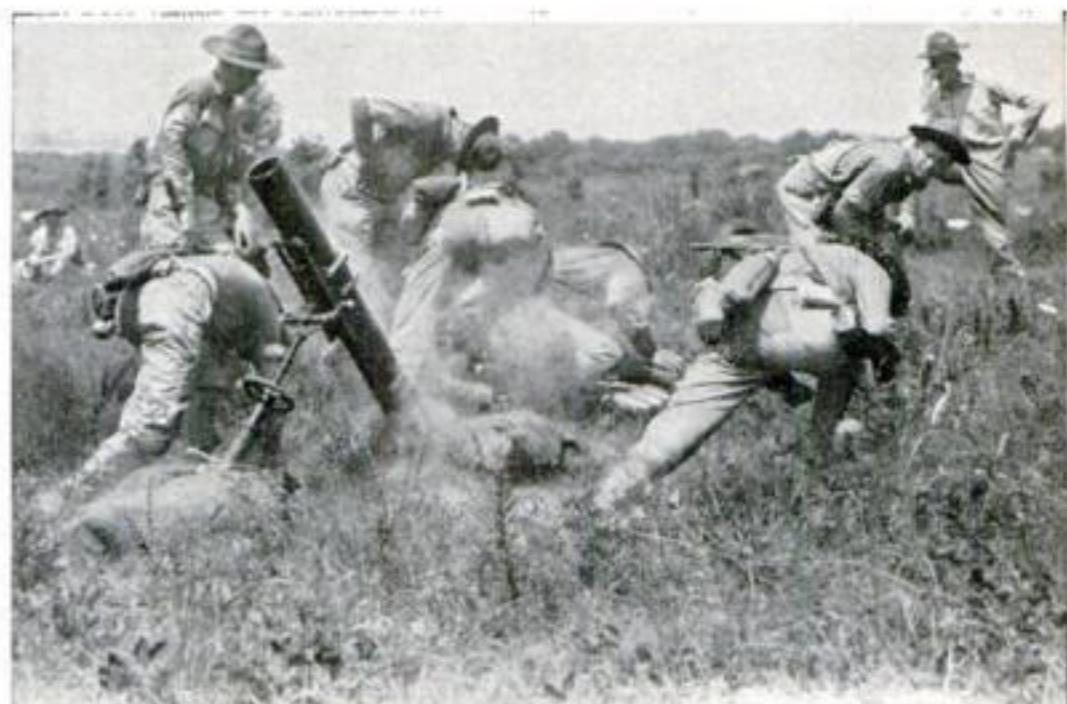
TAKE an enemy by surprise, and he is already half defeated. How smoke screens keep him guessing whether you are attacking, withdrawing, receiving reinforcements, or shifting troops was recently demonstrated at Edgewood Arsenal, Md. Observers saw in ear-splitting action the Army's latest smoke-throwing equipment, developed by its Chemical Warfare Service for every

situation to be encountered in modern war.

The principal weapon of the chemical troops, their 4.2-inch mortar, is ideally suited to the modern style of mobile fighting. Light, speedy trucks and rubber-tired hand carts whirl the mortars into position. Two to five minutes more, and they are set up and firing 25-pound projectiles containing smoke or other fillings. Dropping a shell



Firing a smoke projectile with the latest 4.2-inch mortar. The shell is dropped down the muzzle, as at left, and the four men of the crew fall away. Note rifling in photo above





Mobility makes the mortar ideal for fast-moving modern war. It is rolled into place on its two-wheeled rubber-tired carriage . . .

Bags of earth help to steady the standard supporting the barrel. Periodic checks with a detachable sight show if it has shifted



. . . and set up for action in only two to five minutes, depending upon whether or not an emplacement has been prepared for it in advance. Here it is ready for firing

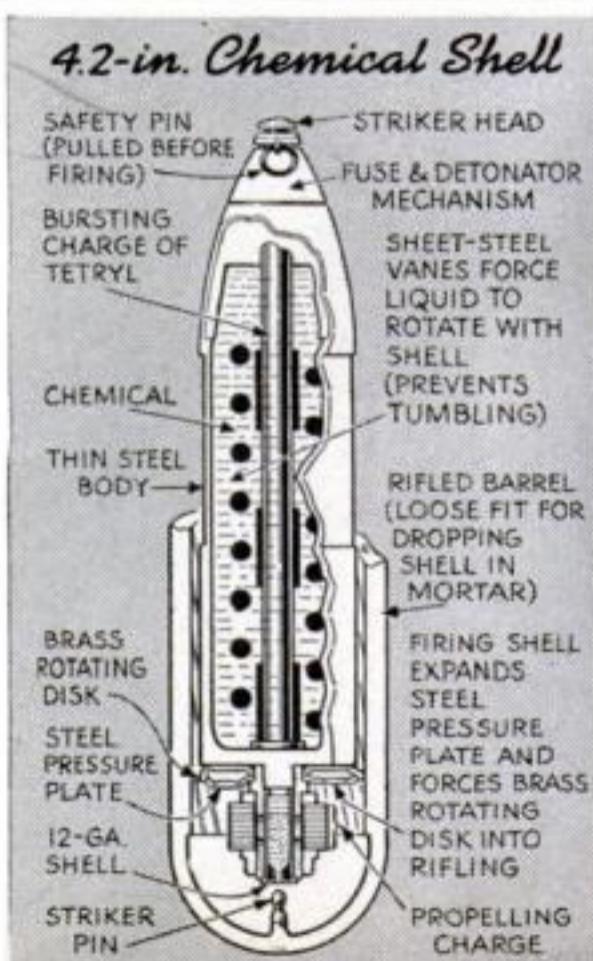
Below is a close-up of a shell being inserted in the muzzle. The black sheets encircling the base of the projectile contain the propelling charge, as seen in the drawing



into the barrel automatically explodes the propelling charge and sends it on its way, so that the mortar fires as fast as it can be fed with ammunition.

A rifled barrel, a major improvement in the mortar, now imparts a whirling motion to the shell to steady it in flight. Consequently the latest design has a maximum range of 2,400 yards—more than double the performance of earlier smoothbore types. To accomplish this, a brass ring called a rotating disk encircles the base of the shell. It just clears the barrel rifling, so that the shell will drop smoothly to the bottom of the mortar. Explosion of the propelling charge, acting against a steel pressure plate, then expands the brass disk to engage the rifling—a clever solution of a perplexing mechanical problem.

Another type of smoke thrower, the Livens projector, fires only once from a single emplacement, in batteries



of 25 or more, and so is best suited to trench or "positional" warfare. Shells used for training contain a smoke mixture. On a battlefield, either smoke or casualty-producing fillings may be used. In preparation for a broadside, the stubby projectors must be dug in, wired to make a complete circuit, and loaded under cover of darkness. A hand-pumped detonator resembling those used in quarry blasting sets off all the projectors at once. Plainly visible in flight, their special 63-pound projectiles resemble tumbling watermelons, as they are hurled to a maximum range of 1,450 yards.

Unlike mortars and projectors, smoke pots depend upon a favorable wind to put smoke just where it is wanted, but such an opportunity cannot be overlooked. The Army's 14-pound type, ignited by hand or electricity, releases grayish-white smoke of high obscuring value for more than six minutes.

Livens projectors are shown in action at the right. The projectiles, looking like tumbling watermelons, may be seen in flight, followed by fragments of the charge boxes and powder bags from emplacements . . .

. . . which are prepared as shown here. Below are the charge box and powder bags containing the maximum propelling charge. Powder bags are put in the charge box, which is then inserted in a projector as seen at the right. Because they have to be planted and wired in advance, Livens projectors are suited only to "positional" use



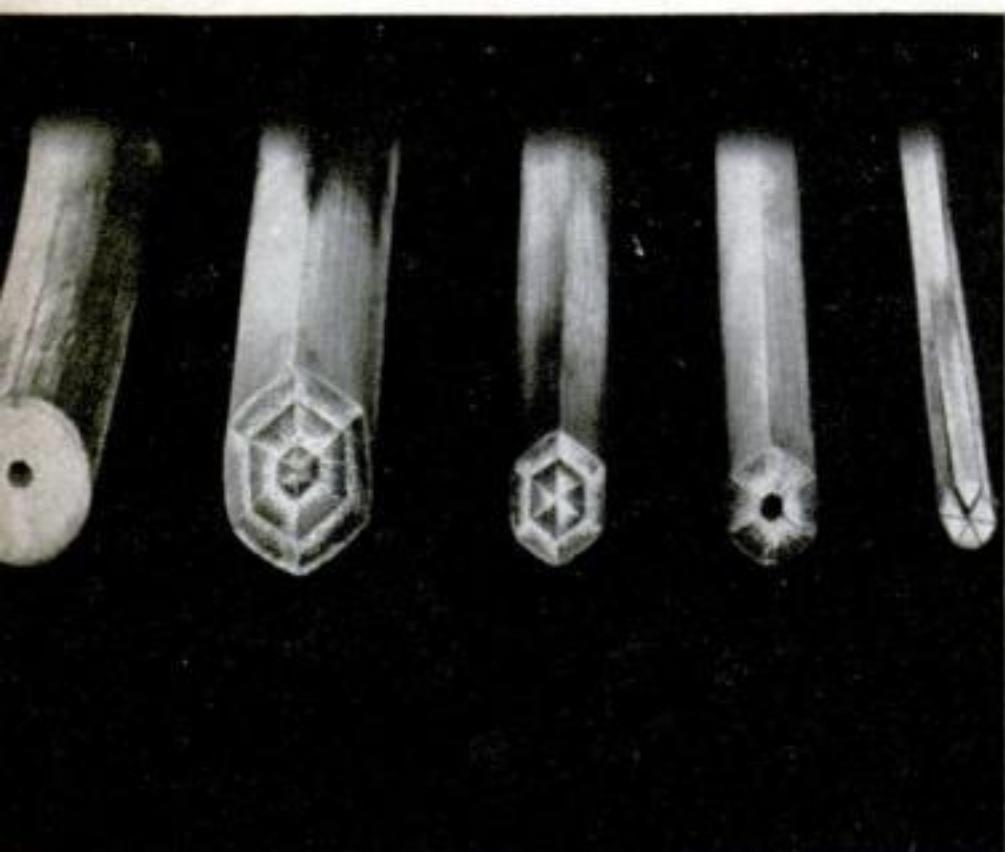
Now the 63-pound projectile goes in. A battery of 25 or more projectors is set off electrically at one time by the use of a hand-pump detonator of the type used in blasting. Just before firing, a soldier makes the rounds and removes the safety pins, which are counted by an officer to insure against "duds"



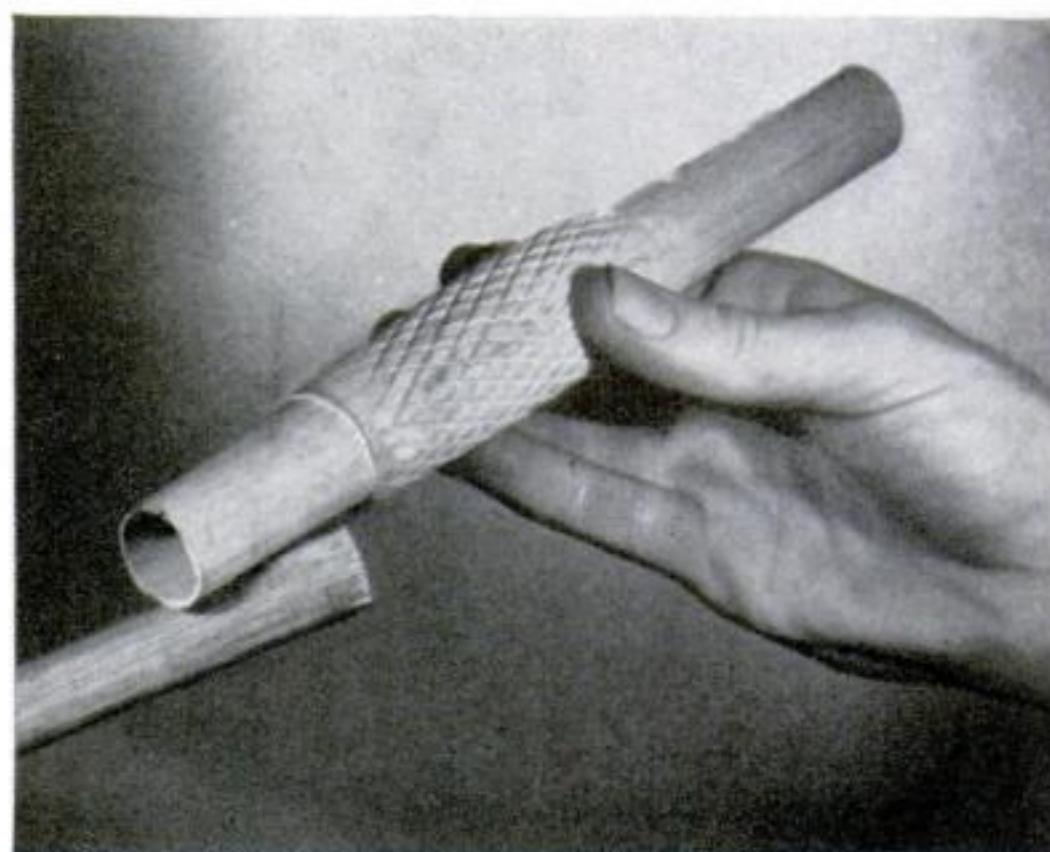
# Surf-Rod Making

**T**RICKS of the trade used by skilled workers in producing surf-fishing rods are revealed in this series of detailed photographs. Step by step, they show how a seven-foot piece of hexagonal bamboo and a few fittings are transformed into the finished rod. By using cord in place of fine thread, the photographer has illustrated the manner in which the experts produce their invisible knots, by means of a slip loop,

when winding silk to hold the grip and guide. Coated with silk preserver and varnish, the wound silk remains solidly in place. A strip of adhesive tape simplifies the job of attaching the stainless-steel guide to the rod. Strapped over one arm of the guide, it holds the fitting in place while the silk is wound over the other arm. So detailed are the photographs that they could guide you in making a rod of your own.



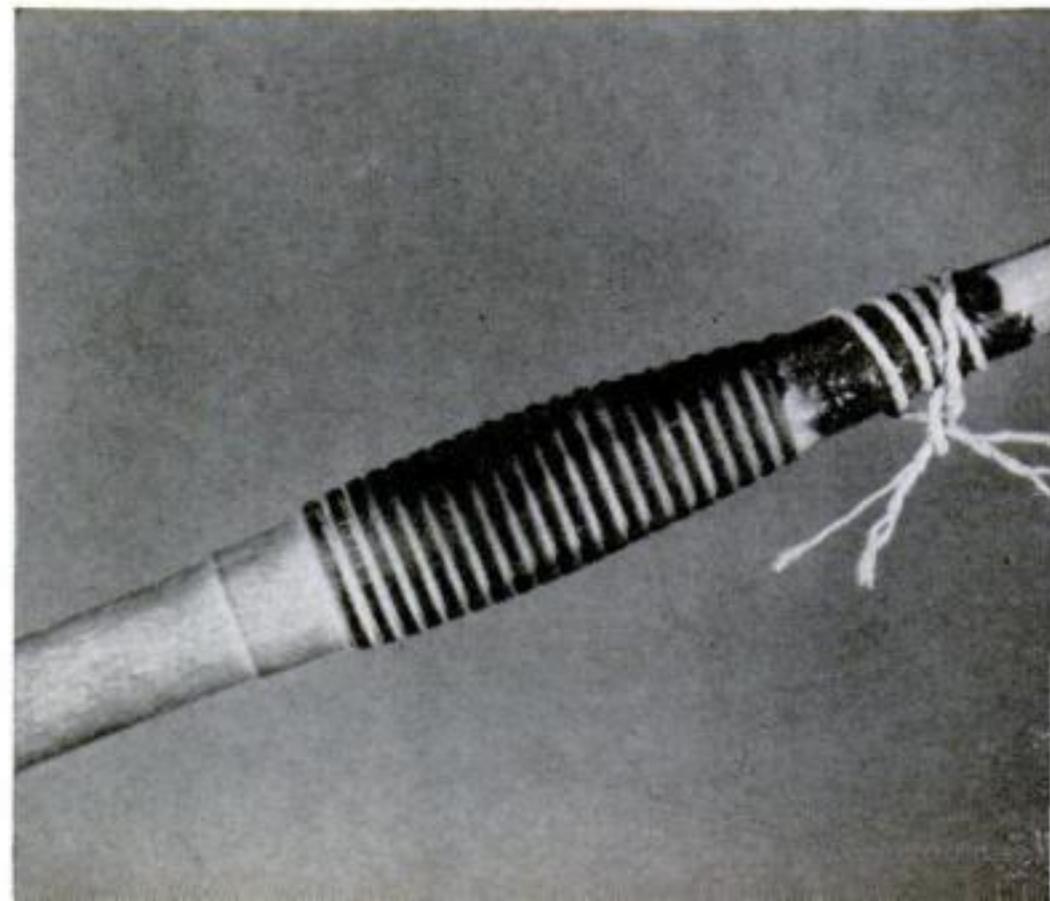
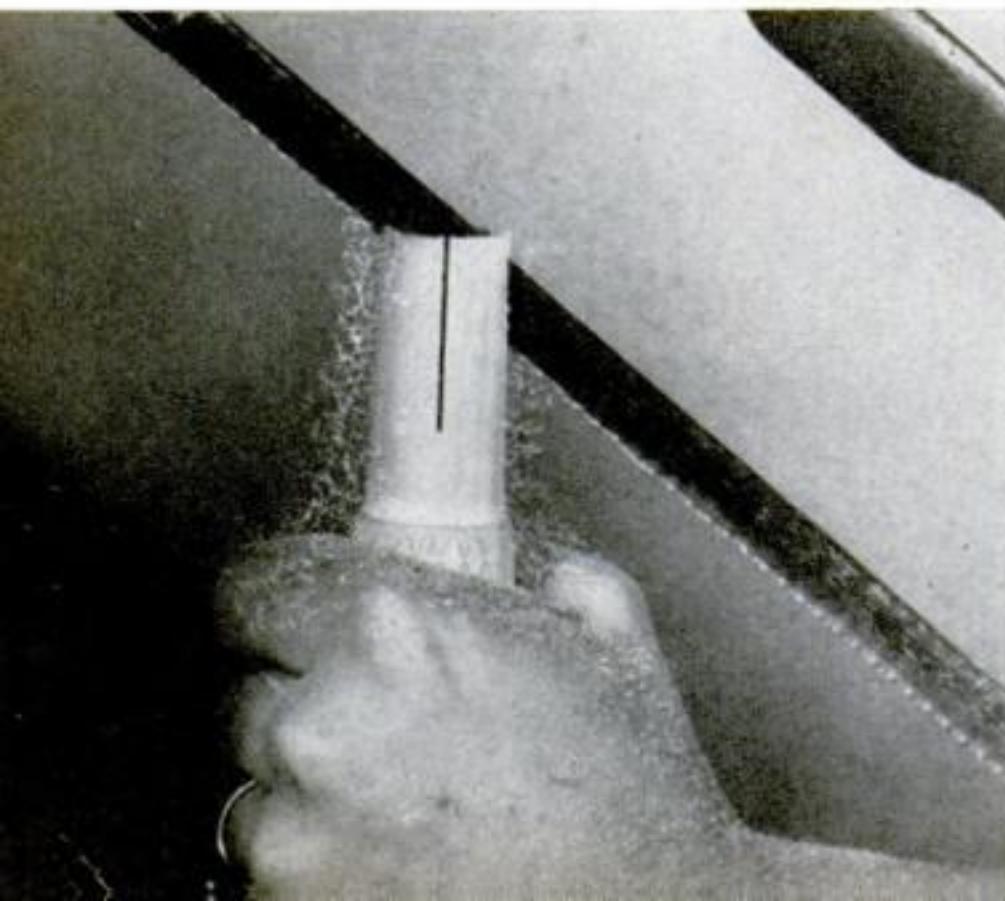
Split bamboo for surf rods is made of Chinese cane (left) split in strips and glued together. A triple-built rod has 18 strips; double-built, 12 strips; the conventional rod, six strips

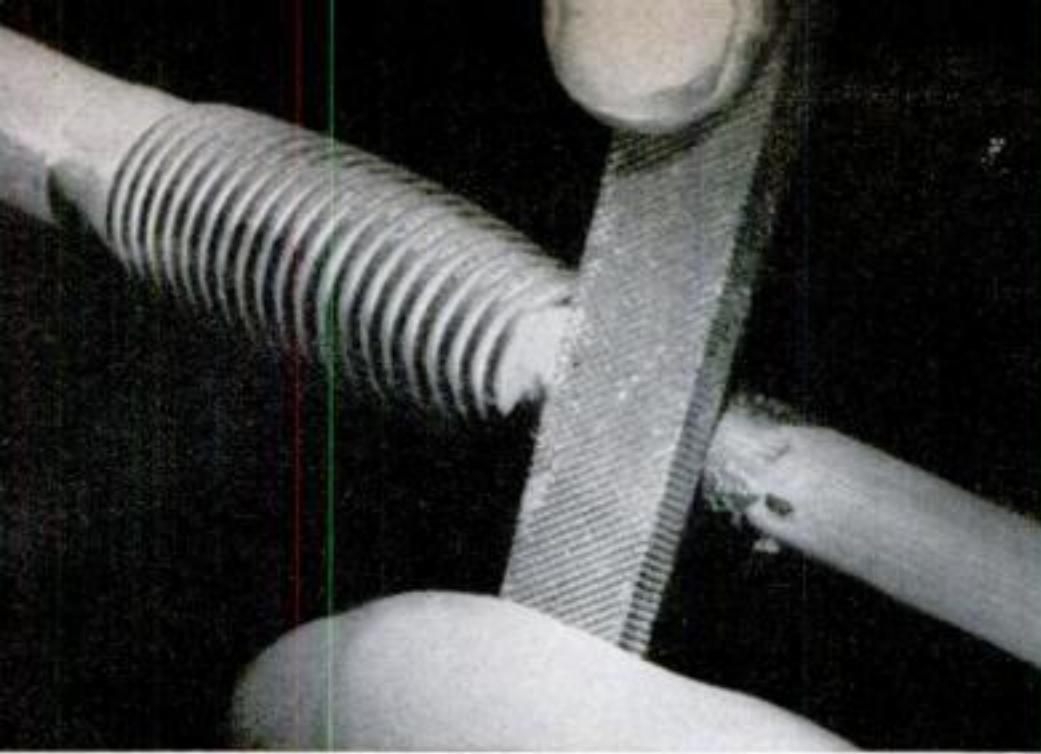


Here is the wooden grip, ready to be fitted to the end of the rod. The hexagonal bamboo must be rounded to conform to the round hole in the grip. This is done by filing down the corners to get a snug fit

The tip or tapered end of the grip is now slit with a hack saw in three evenly spaced places. This gives six facets to match the hexagonal shape of the bamboo when it goes on the tip . . .

. . . as shown below. Before inserting in the grip, glue is spread on the filed portion of the bamboo. Lashing of the grip facets to the bamboo, drying, and cleaning off excess glue complete the operation

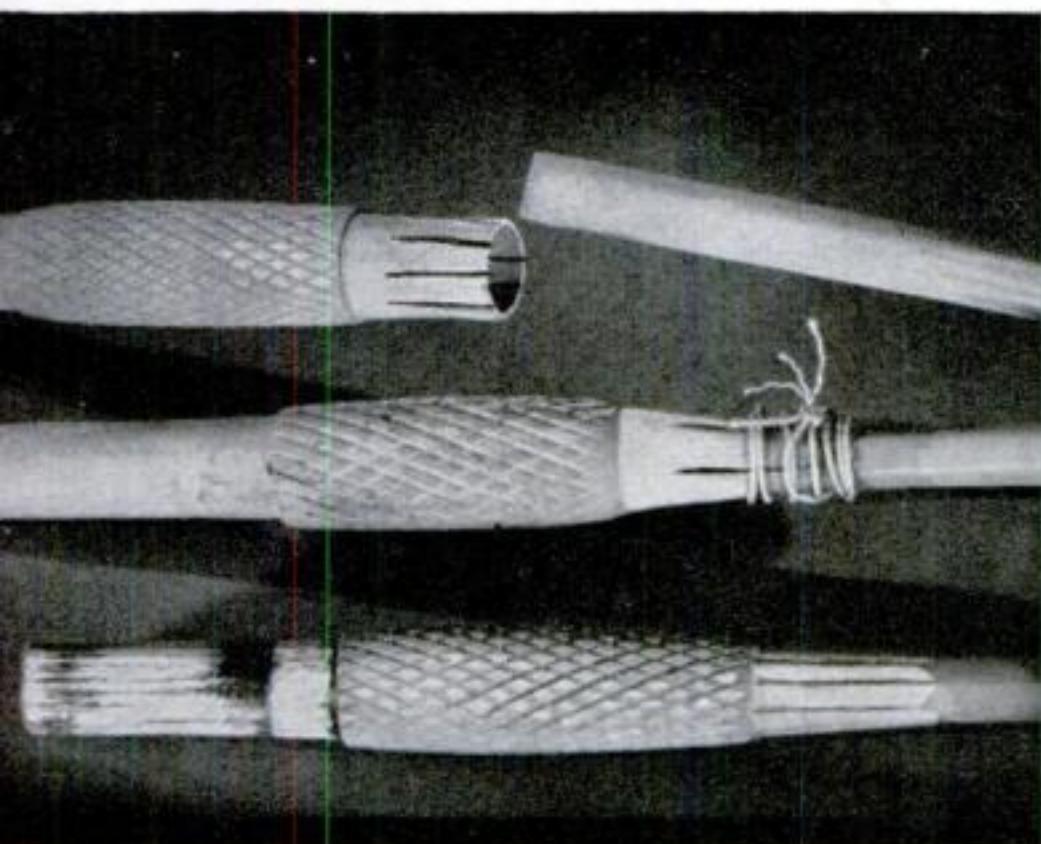




The next step is to file off the grip flush with the tip so that wood and bamboo blend imperceptibly. Glue is not used anywhere except in attaching grip to tip



To mount the butt cap, heat ferrule cement and spread it generously on the place prepared for it. Then slip the cap into place for a snug fit



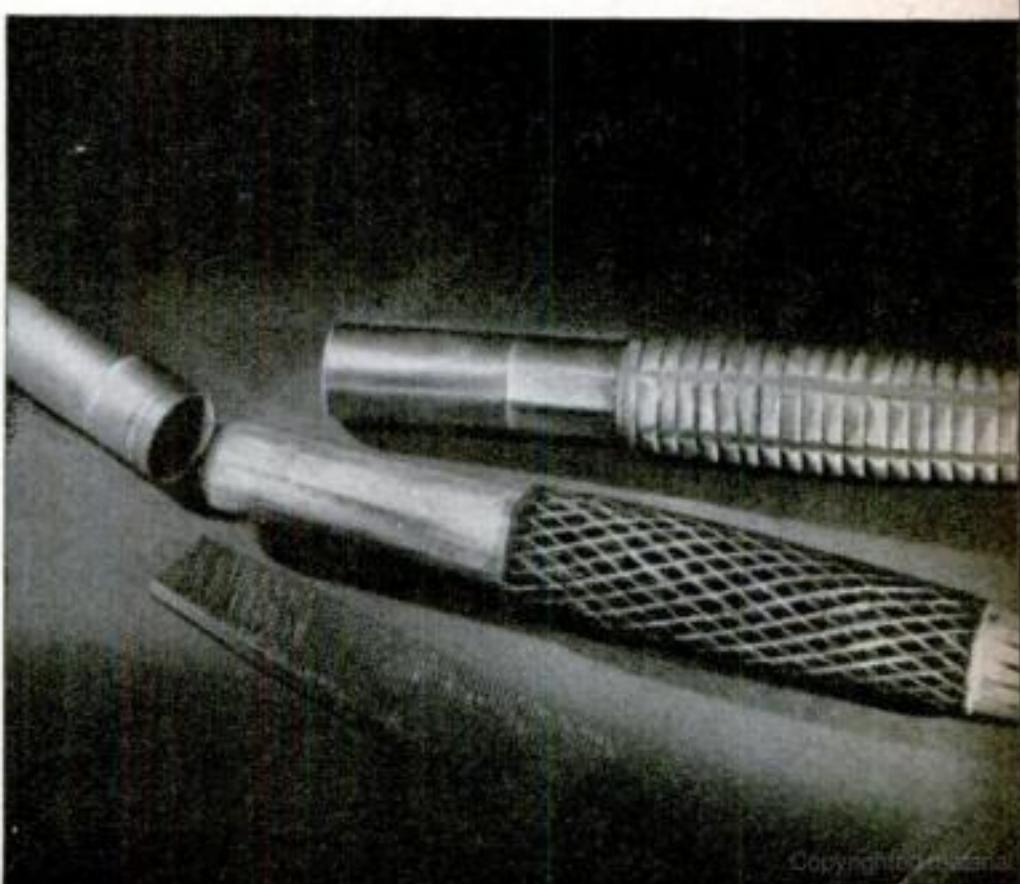
Three stages in the mounting of the grip as described in preceding pictures: In the first, the grip end is slotted; in the second, the grip is glued to the tip and its facets lashed; in the third, lashings removed

Again hot ferrule cement is applied and the ferrule is slipped into place on the grip. After some time has been allowed for drying, excess cement may be chipped away to make a clean joint with the grip



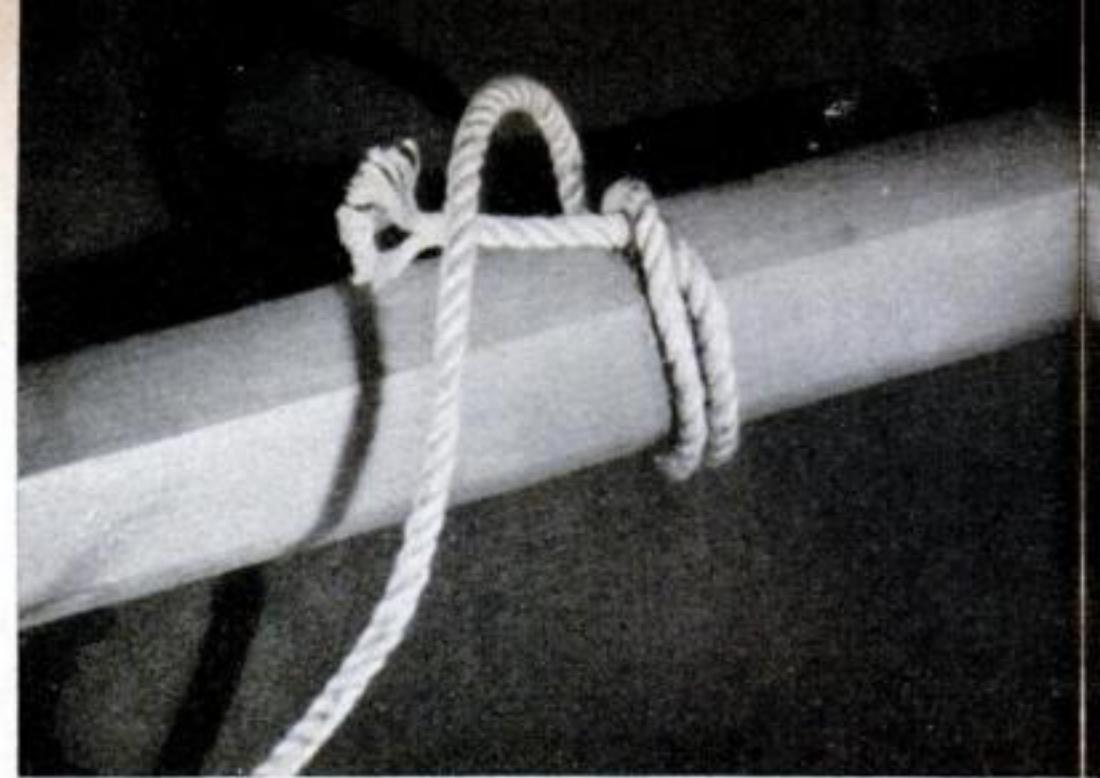
Now we are ready to mount the male ferrule. The grip is first filed down to accommodate the ferrule, which should have been selected carefully for size when purchased at a sports store

Below are shown a grip prepared for mounting the male ferrule, and another with the ferrule in place. The ferrule is heated slightly before it is slipped on, to expand the metal (Continued)

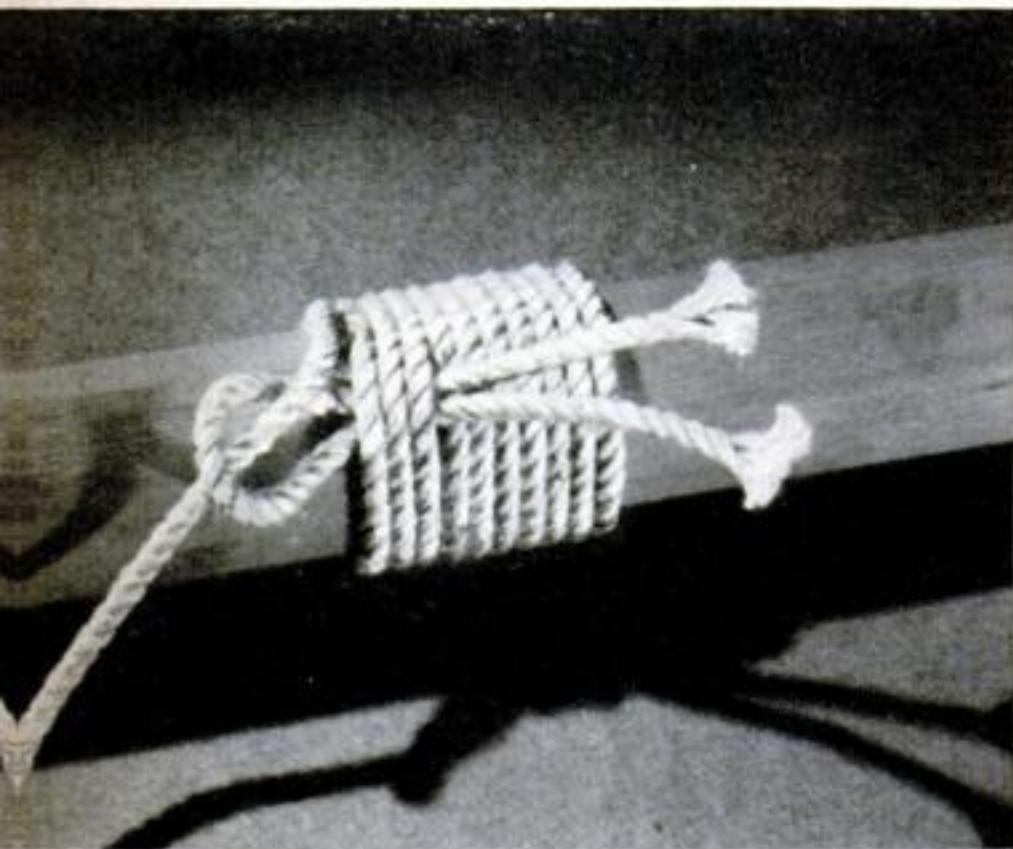




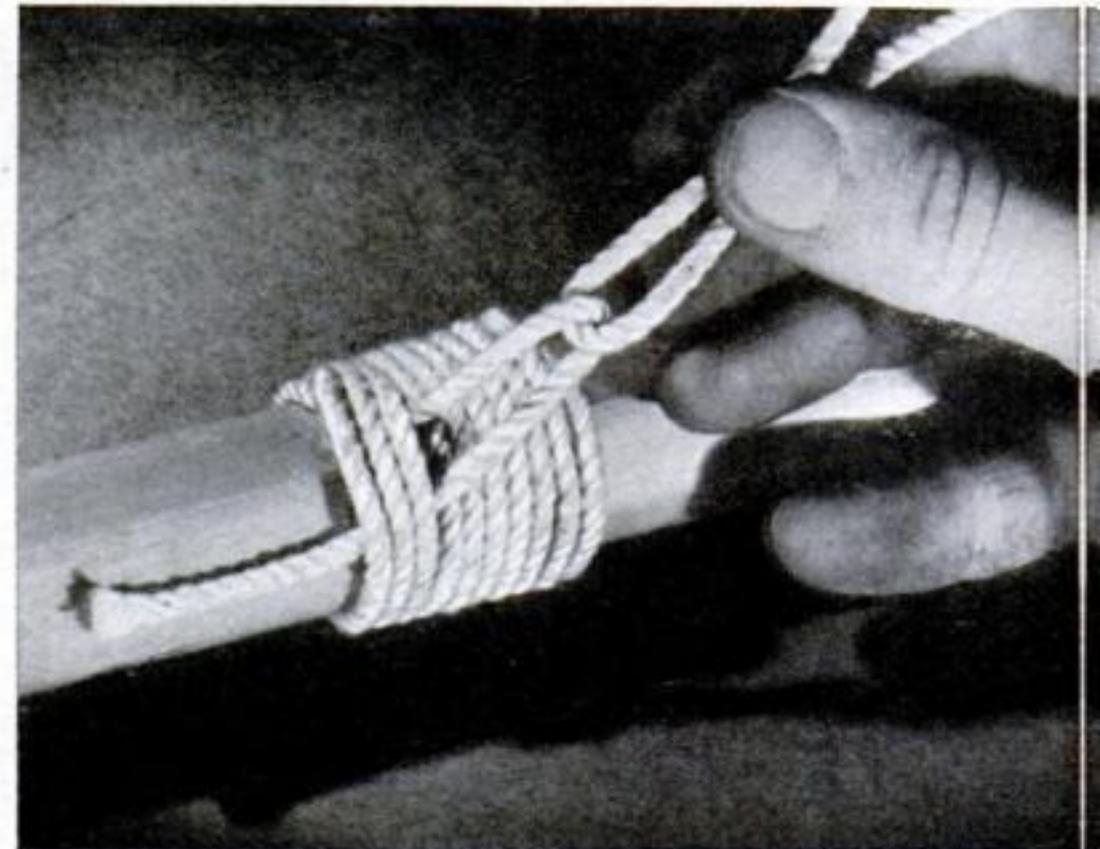
Now the reel seat is mounted on the butt. Here some more filing is necessary. The stainless-steel offset tip will be cemented on after . . .



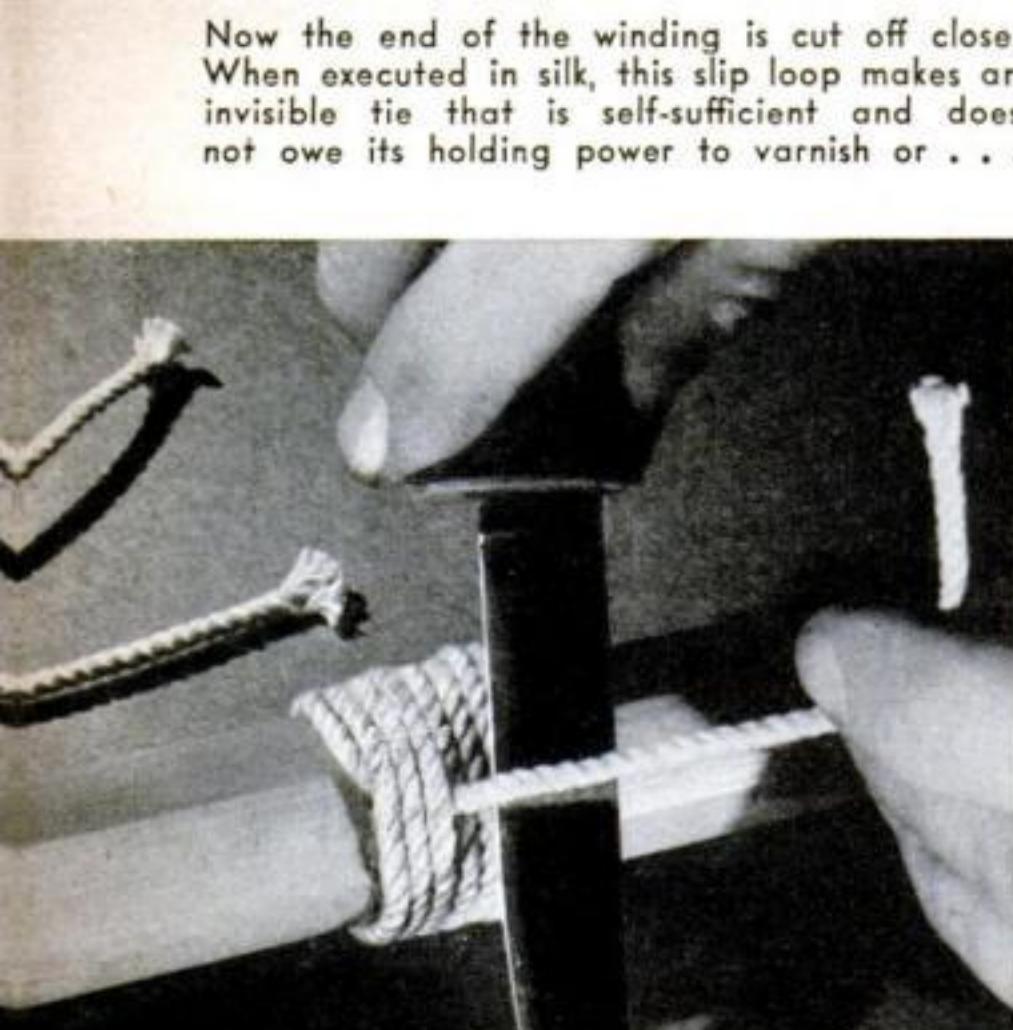
. . . the winding of the grip, which is illustrated here with heavy cord instead of fine silk to show the slip loop. This is how the winding is started



Near the end of the winding, which should be 4 to 12 inches long, a small loop is laid as shown and the winding is continued on top of it. Then the end of the silk is passed through the loop



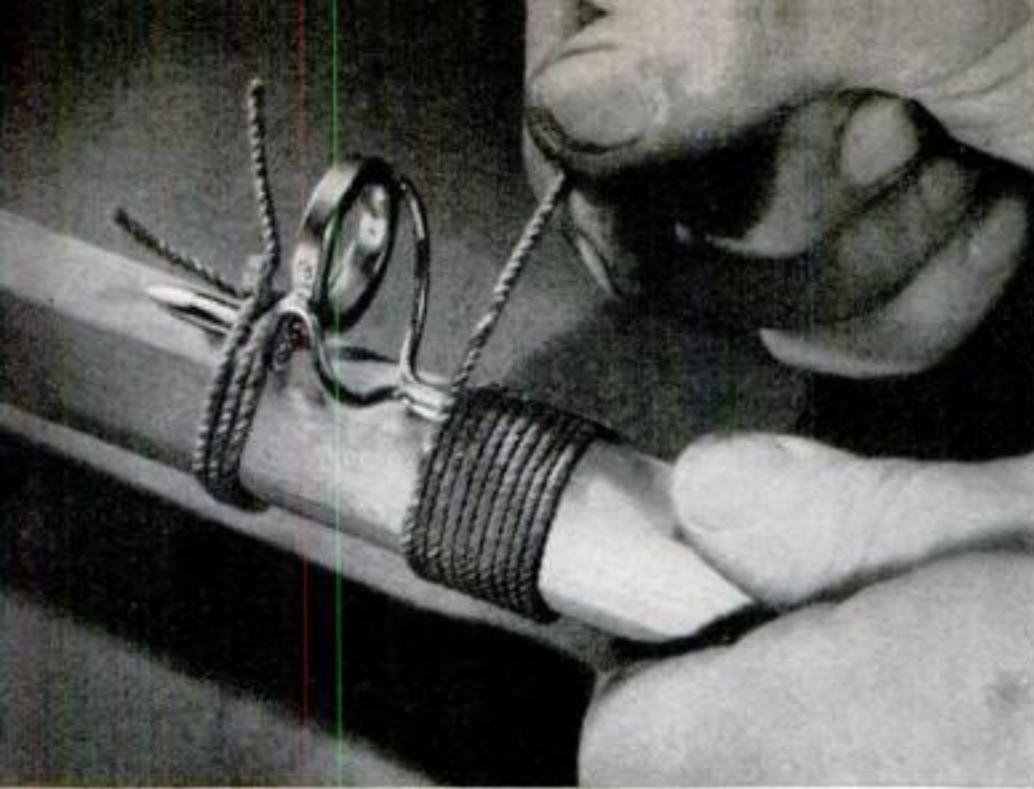
. . . and drawn underneath the overlapping turns. Any space left between the strands of the winding may be closed up by pushing the strands together with the fingernail to produce a close, smooth effect



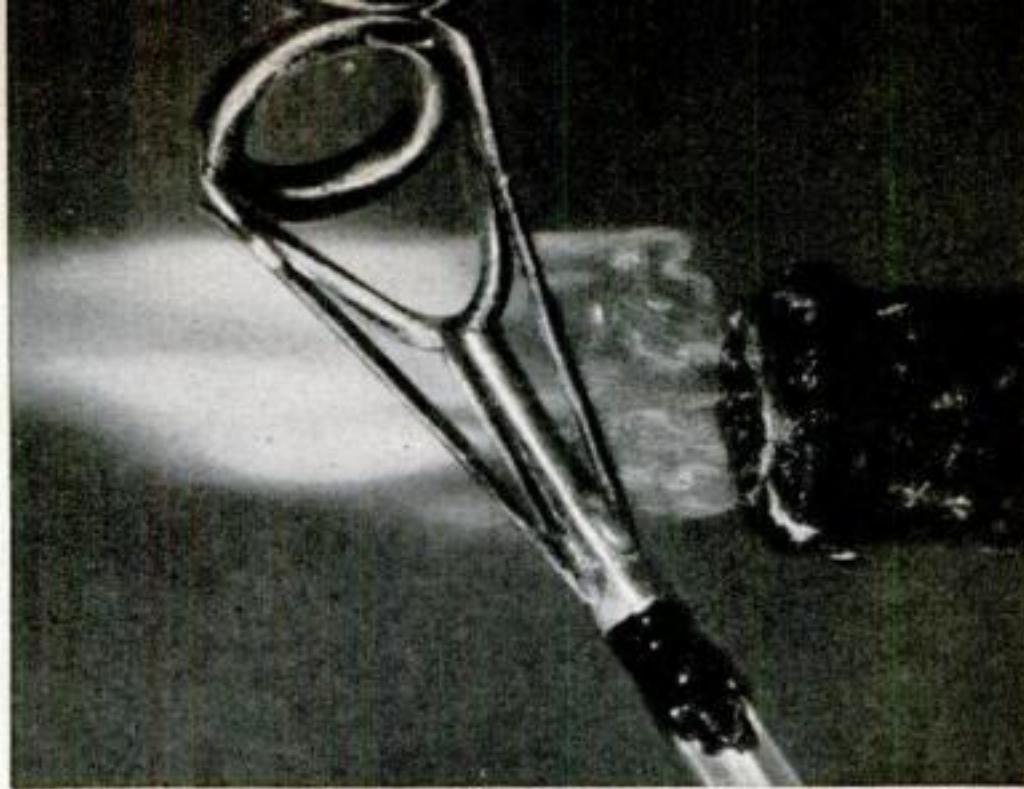
Now the end of the winding is cut off close. When executed in silk, this slip loop makes an invisible tie that is self-sufficient and does not owe its holding power to varnish or . . .



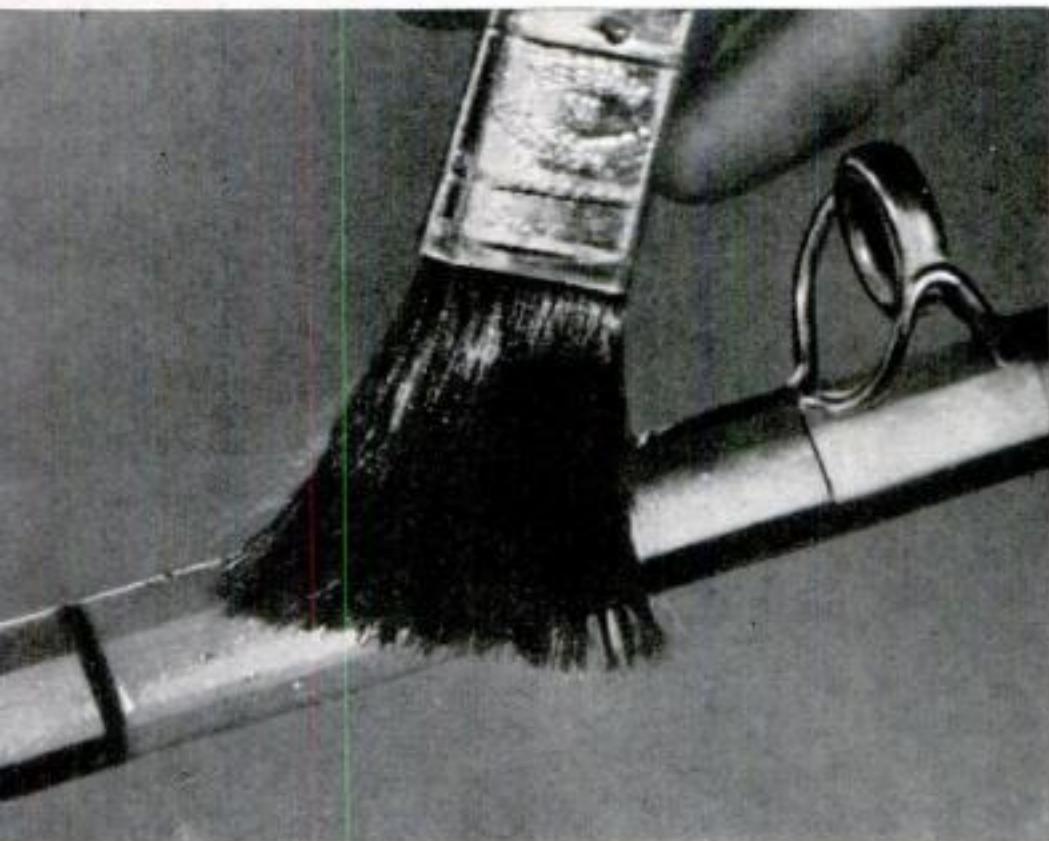
. . . silk preserver, which is being applied below. A small brush may be used, or a pipe cleaner as illustrated. All silk windings on the rod get this treatment, which protects them from discoloration



To mount the stainless-steel guide, one arm is held on the rod with cord or adhesive tape while the other is wound with silk in the same manner as the grip



Heating prepares the stainless-steel tip for cementing on the top of the rod, which is filed to receive it. The base of the tip is then wound



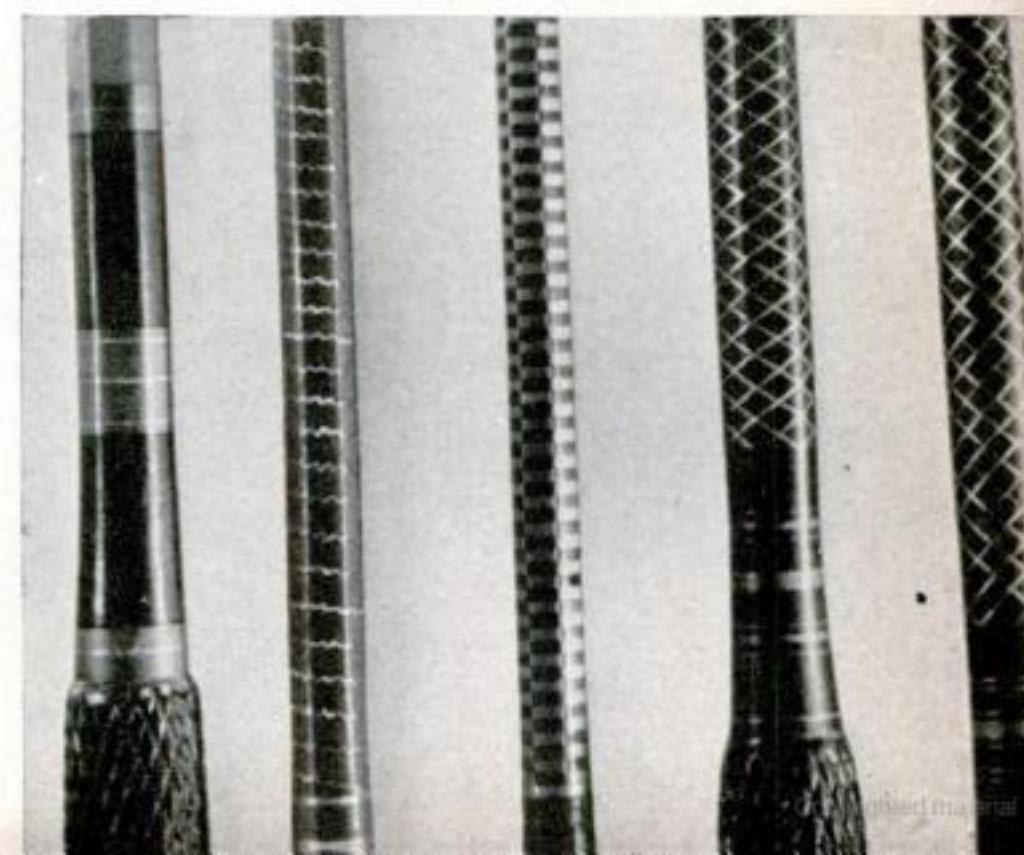
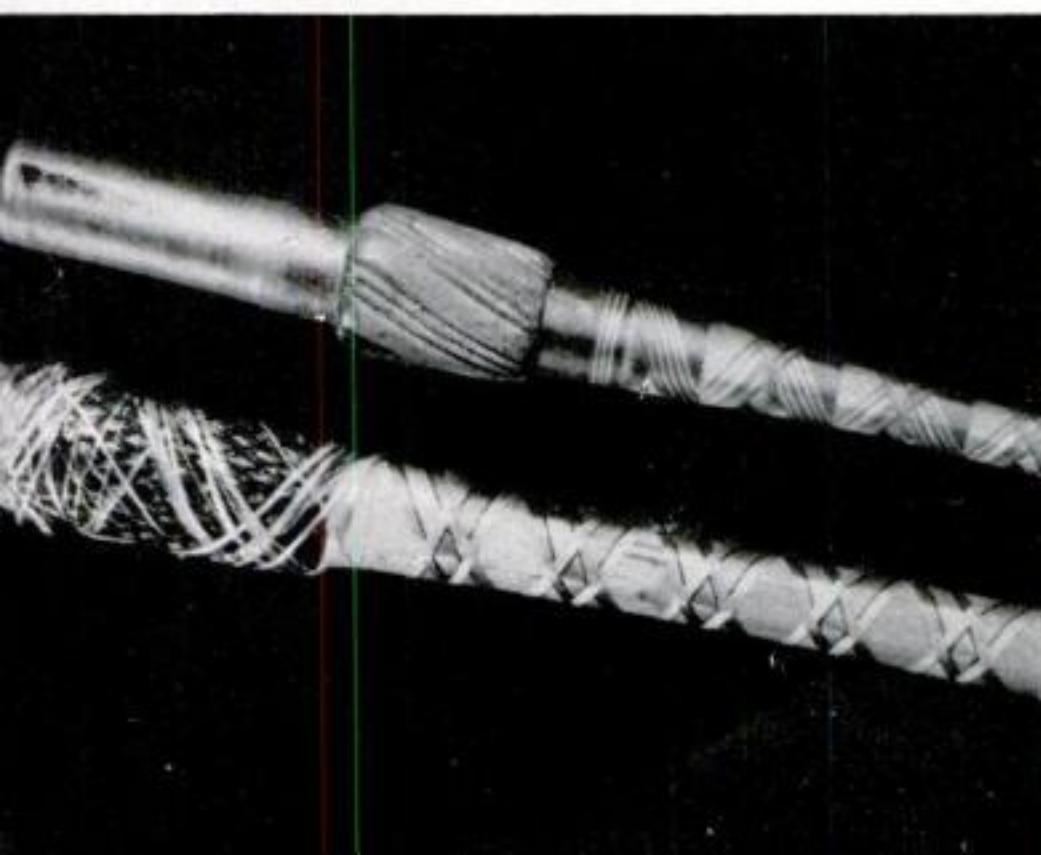
Varnishing is important, to preserve the rod from damage by weather and water. At least five coats should be applied, using even, downward strokes to eliminate air bubbles. Do not cover too much at once



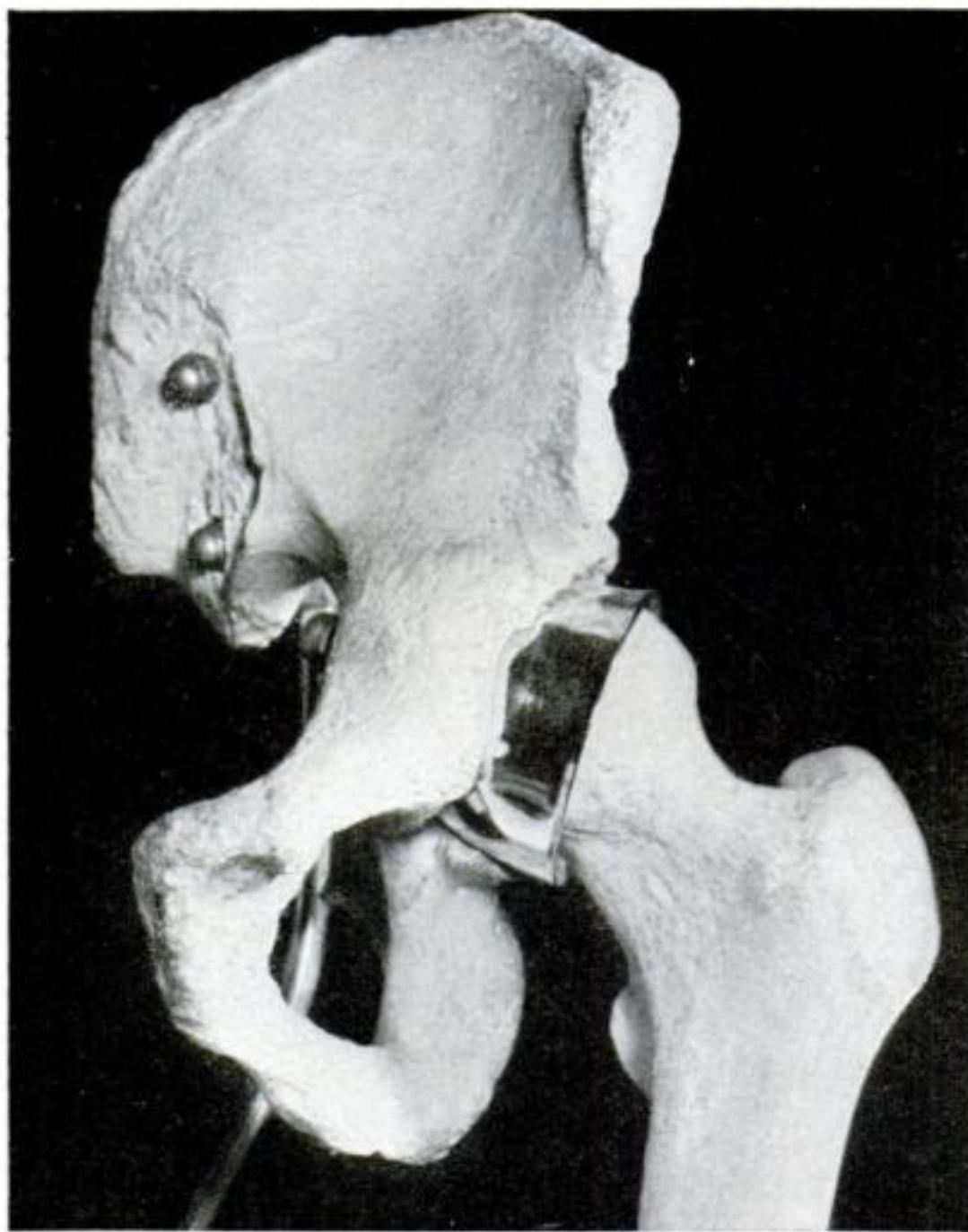
Before the last coat of varnish is applied, the rod is allowed to dry thoroughly and is rubbed down with steel wool. With the final coat on, the rod is rubbed down with pumice and water

While the windings described are all that are needed to strengthen the rod, additional windings are often used to beautify it, and special effects are possible with more difficult windings like those shown here . . .

. . . and here. For proper care, any rod should be given a new coat of varnish every year, dried after each use, kept away from steam heat, and hung from its tip whenever it is not being used



# Metal That Mends Bones



A cap of Vitallium, inserted in the hip as shown above, enables a patient long bedridden with arthritis to walk again

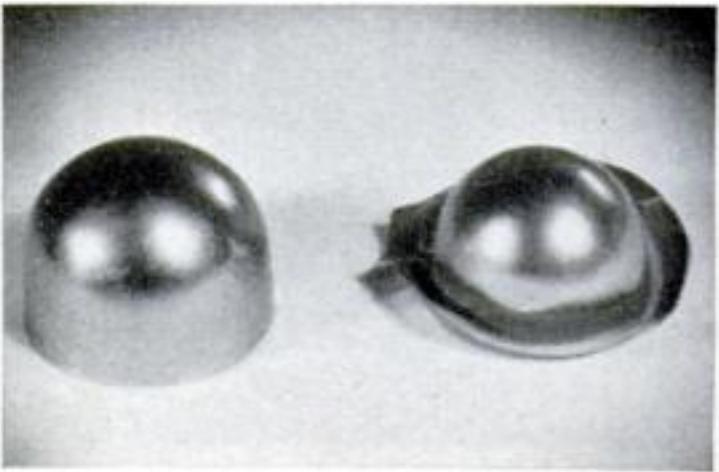
The workman below is polishing up a Vitallium hip cap in the factory. The new alloy is the first metal ever produced that has all the qualities required for surgical carpentry



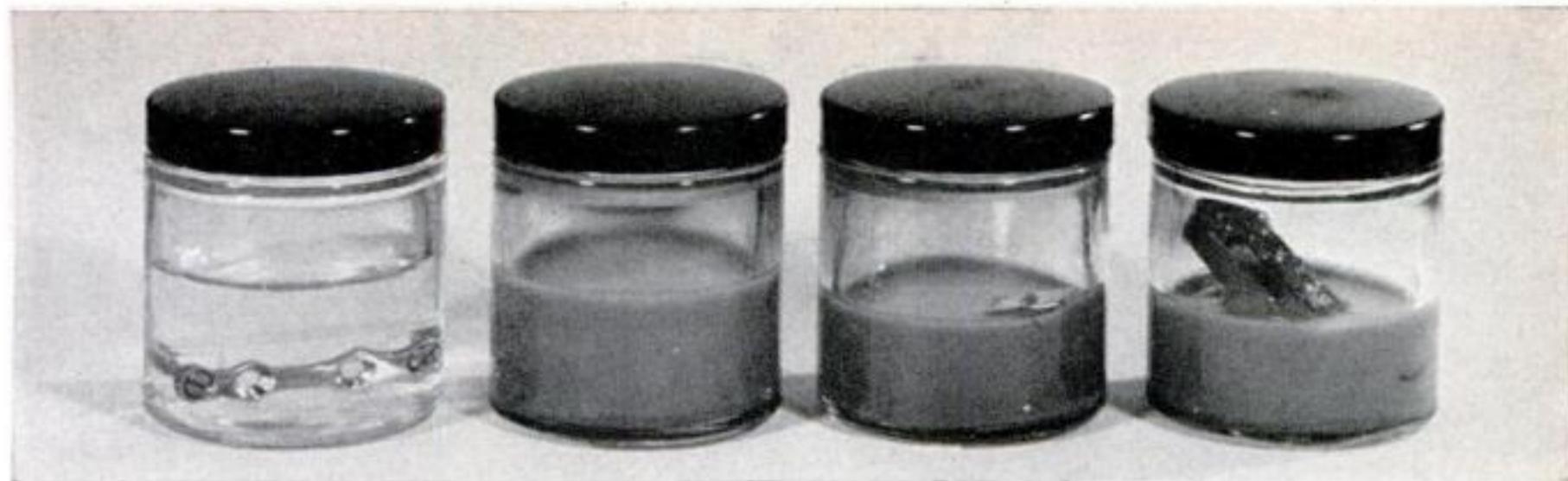
## NEW ALLOY PERMITS AMAZING FEATS OF SURGICAL CARPENTRY

LIFESAVING feats of surgery, hitherto impossible, are being achieved with the aid of a remarkable new alloy. It provides surgeons, for the first time in medical history, with a metal that can be implanted permanently in the human body. Inert, non-corrosive, non-irritating, lightweight, and strong, this alloy, known as Vitallium, is producing revolutionary surgical accomplishments.

Patients bedridden for years with arthritic hips can walk



In the upper picture, a finished hip cap, left, contrasted with a rough one fresh from the mold. For preparing the caps, a wax pattern is placed in a container and covered with a special molding material as shown above. Heating removes the wax pattern, leaving the mold for the alloy



Vitallium body hardware, in the jar at left, is uncorroded after a week in saline solution. For contrast, the other jars show effect on vanadium steel, chromium plate, and stainless steel nickel-plated

again when caps of the metal are placed in the hip joints. Fingers stiff with arthritis have been made flexible by a similar insertion of Vitallium caps in the affected joints. Stoppage of the bile duct, formerly almost always fatal, is being cured by means of tiny tubes of the new alloy.

Screws, nails, and plates, employed in surgical carpentry and the repair of fractures, can now be left in place, eliminating the necessity of a second operation for their

removal. The United States Government recently placed orders for more than 150,000 Vitallium fracture plates and screws. Artificial teeth can be implanted in jaws by means of screws. So non-irritating is Vitallium that bone will grow around it.

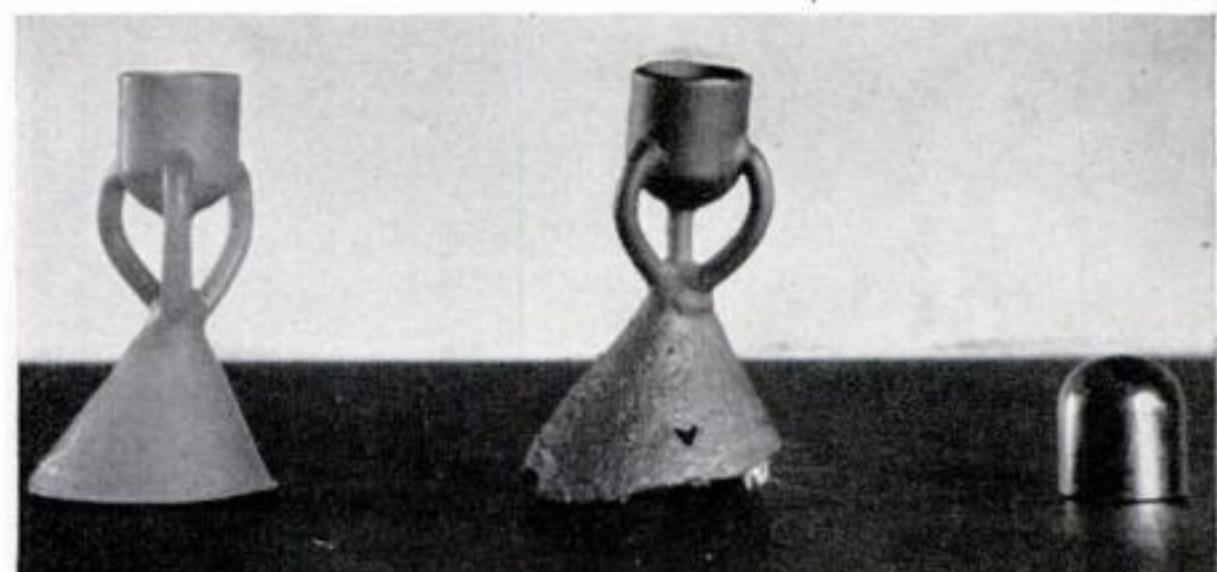
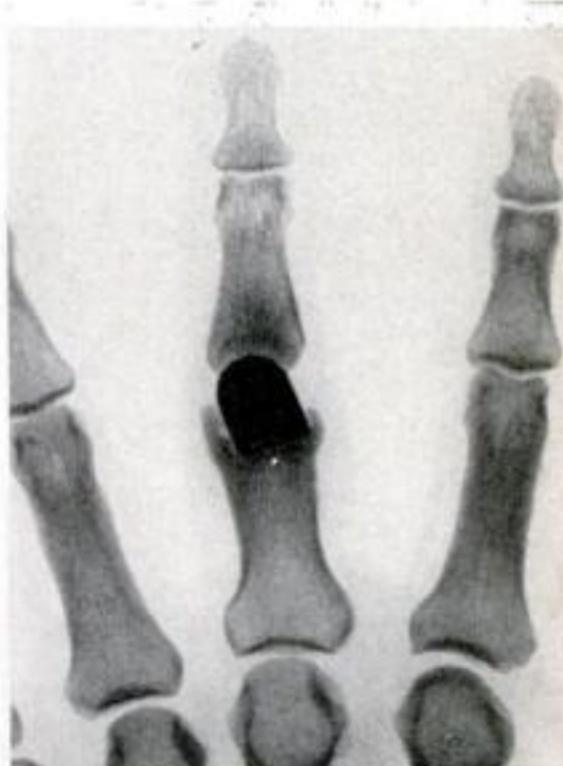
The main constituents of the patented alloy, which is the product of years of intensive research by two American experimenters, R. W. Erdle and C. H. Prange, are cobalt, chromium, and molybdenum.

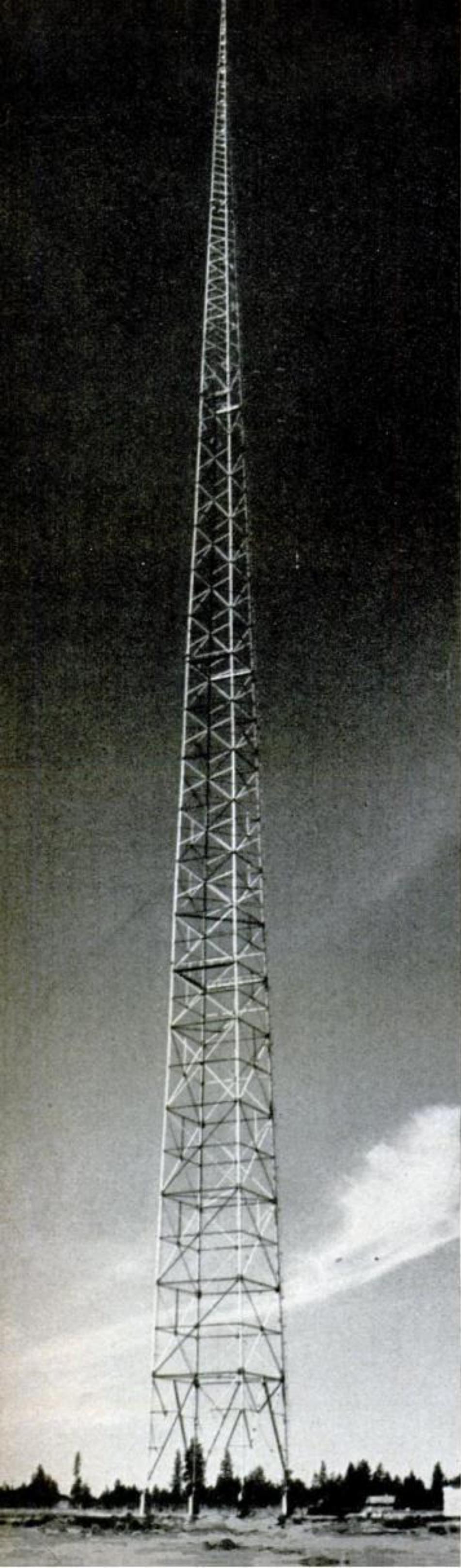


PLATES, NAILS, AND SCREWS of the new alloy for use in surgery. The X-ray photograph at right shows how screws are driven into a fractured bone. The metal makes their removal unnecessary



FINGER-JOINT CAPS like the one in the X-ray were developed by Dr. M. S. Burman to loosen joints stiffened by arthritis. Below, left to right, are wax pattern, rough casting, and finished job





# Heated Insulators

## Safeguard Radio- Range Beacons

**S**TRETCHING like a safety chain along Canada's northernmost borders, radio range stations made possible by a new, heated tower insulator are being built to help protect North America from invasion. The stations, each having four triangular towers, will be spaced about 250 miles apart, and will guide commercial and military aircraft through territory that includes the frozen arctic. They will make it possible for fighter planes to speed unerringly to meet an invader.

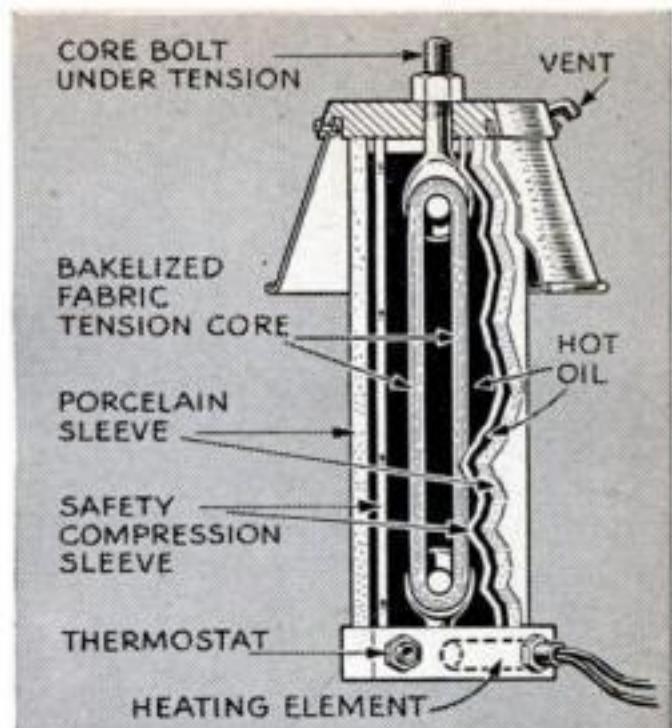
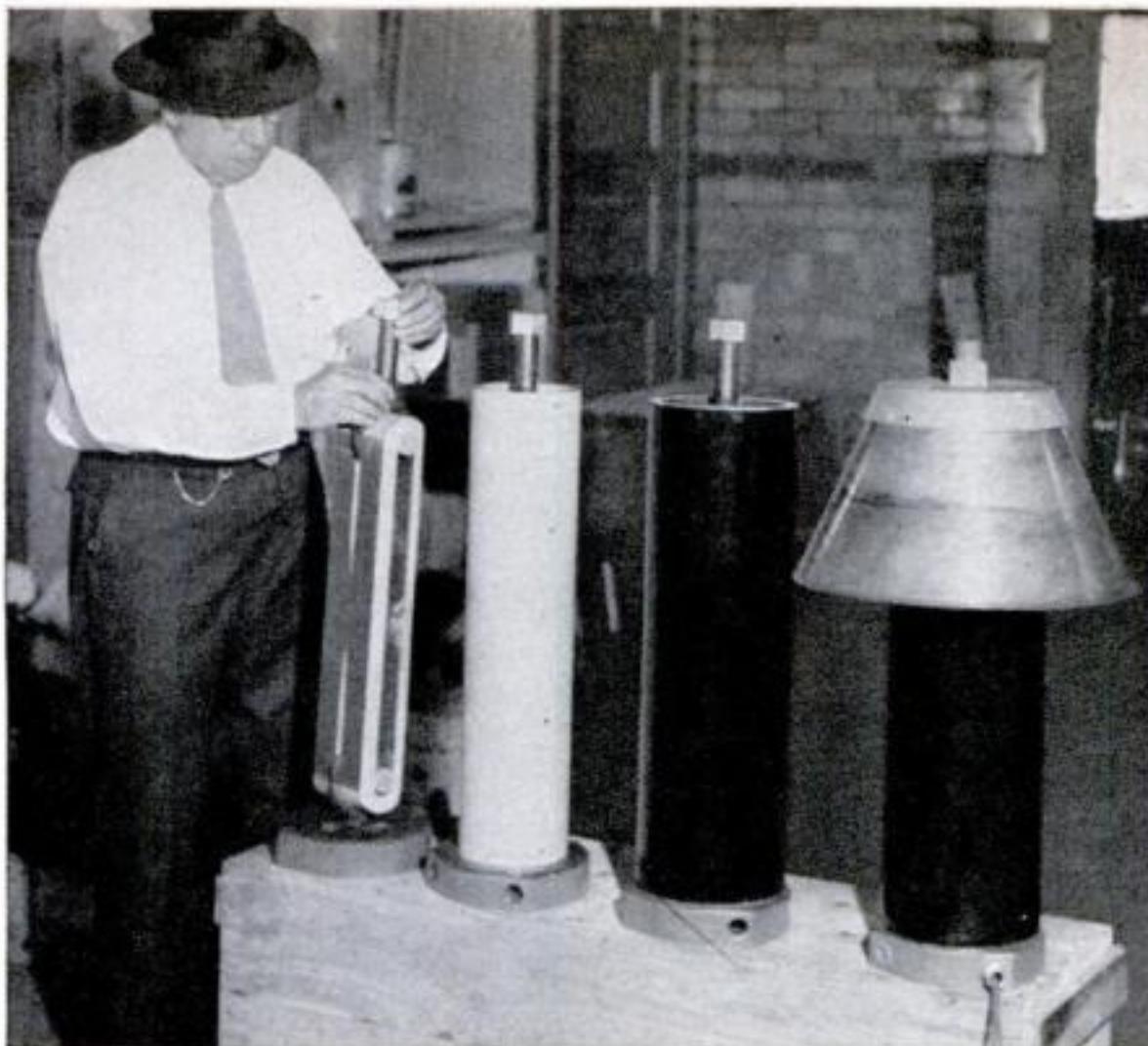
A radio tower is separated electrically from the earth by insulators near its base. Porcelain is the most satisfactory insulator material yet discovered, but it is easily broken. Conventional insulators are sometimes so fragile that a boy with a hammer or a .22 caliber rifle could send a tower tumbling to the ground simply by destroying one of the porcelain sections.

Arthur O. Austin, of Barberton, Ohio, an authority on transmission lines, insulation, high-frequency currents, and radio broadcasting equipment, has found a way of combatting this fragility and at the same time improving the uniformity and strength of a station's signal. He does this with an oil-filled, electrically heated porcelain insulator he invented.

This insulator has a porcelain compression tube, and inside it a non-shattering bakelite safety sleeve which supports the tower if the porcelain is

Its steel network reaching up 805 feet into the air and tapering from a base 40 feet square, this giant antenna at Station KHQ, Spokane, in which have been installed self-drying insulators, produces better coverage than with its original equipment. Below, insulators in place in a Canadian radio-range tower



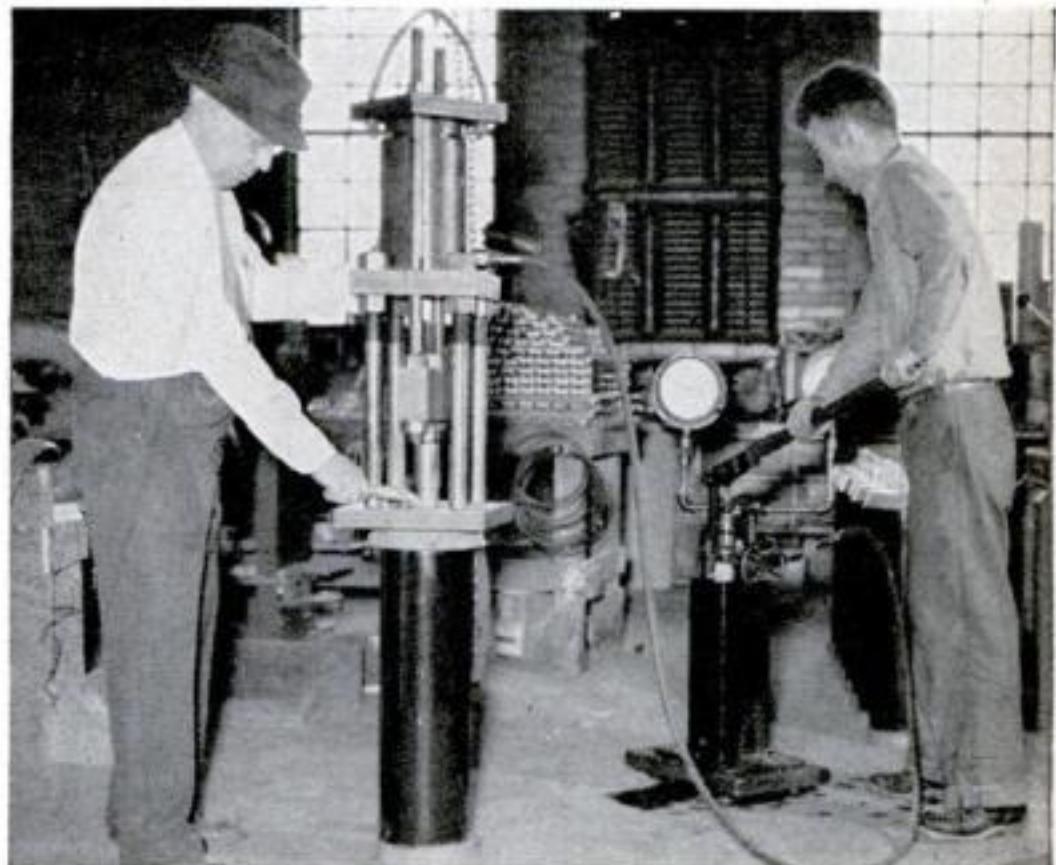


Arthur O. Austin, left, shows stages in assembling his insulator. In the photo, left to right, a tension bolt is adjusted in a tension link; next a safety sleeve is slipped on; then the porcelain tube is put on; finally, a completed insulator with rain shield

broken. Inside the sleeve is a bakelized-fabric tension link which connects bolts that pass through metal end hoods. This bakelite link pulls the caps against the porcelain with a force of about 17 tons, which strengthens the compression tube because porcelain is strongest when compressed. The insulator is filled with oil to prevent electrical discharges inside the tube. It also transfers heat to the porcelain from a 120-watt, 230-volt resistance unit in the base. One insulator of each set has a thermostat that keeps the oil temperature uniform and keeps the temperature of the insulator surface above the dew point, so moisture films will not form during fog or rising temperature and cause leakage of costly radio-frequency energy or alter the station beam. Electrical discharges over a moist surface are very erratic and unpredictable.

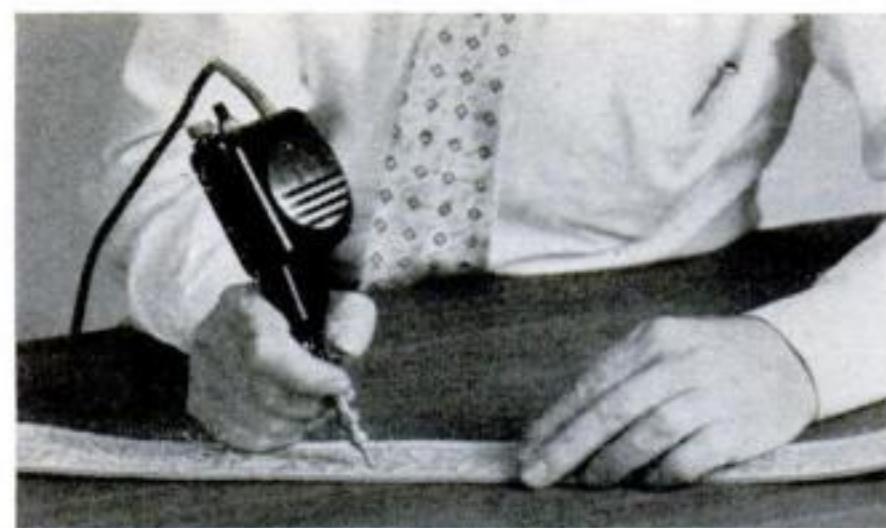
Rapid changes in radio beams guiding airplanes are often traceable to fog-drenched insulators, and such sudden beam shifting may cause a pilot to lose his course and crack up his ship.

In the center photo, Austin and a helper pre-load an insulator with a hydraulic ram that compresses the porcelain with a force of 50,000 pounds, increasing its strength. At bottom, workmen installing the insulators in a Canadian range tower

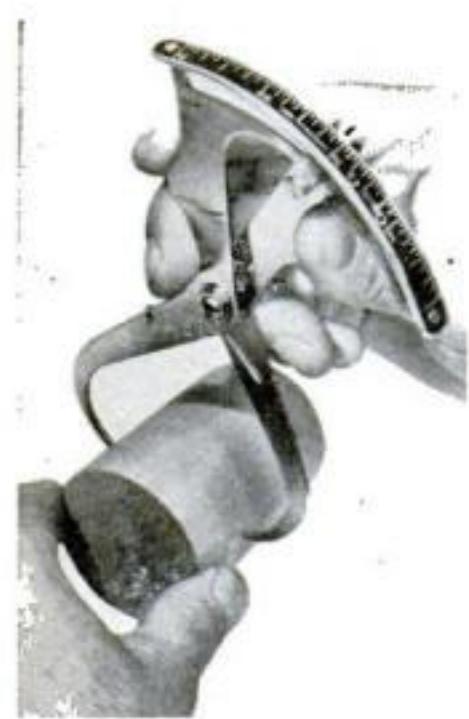


# New Tools

A VIBRATING TOOL which makes 7,200 strokes a minute, with strokes adjustable up to  $\frac{1}{8}$  inch, is used for engraving, cutting, hammering, or carving on metal, wood, linoleum, sheet rubber, sheet cork, glass, ceramics, and most other materials. A ball grip permits easy handling and accurate control. Accessories include fine and coarse needles for engraving, tungsten-tipped needles for glass and ceramics, knife blades, hammer tips, special cutters, and a foot gauge for controlling the depth of the cut. The tool remains cool in continuous operation.



MIDGET TOOLS are often needed by repair men for use on compactly designed, streamlined machines, into which bulky tools will not fit. Tools which resemble toys but which are strong enough for most work have been designed to meet this problem. Miniature pliers, hammers, sockets and attachments, wrenches, punches, chisels, pry bars, and spanners are now available. Among them is the world's smallest reversible ratchet. These tools are especially adapted to ignition, carburetor, radio, and refrigeration work, and other jobs in which it is necessary to slip instruments into confined spaces.



A DIRECT-READING CALIPER of four-inch size has been designed for home craftsmen and others who benefit by easier caliper reading. The scale, graduated in thirty-seconds, is directly in front of the user, and the markings are bright on a black background.

A SELF-PUNCHING center punch that supplies its own kick has been placed on the market. The hardened point is put on the spot to be marked, and the handle is pushed until a snap drives the point into the work.



# Portable Cableway



An Army vehicle crosses a river in a test of the military cableway invented by Lt. Col. R. B. Lord of the Corps of Engineers



Rope slings under the wheels suspend a truck from the trolley, which is pulled along the 1½-inch steel cable by a lead line

A truck and trailer carry a complete mobile-cableway unit along roads to the site for a crossing. Boats are not regular equipment



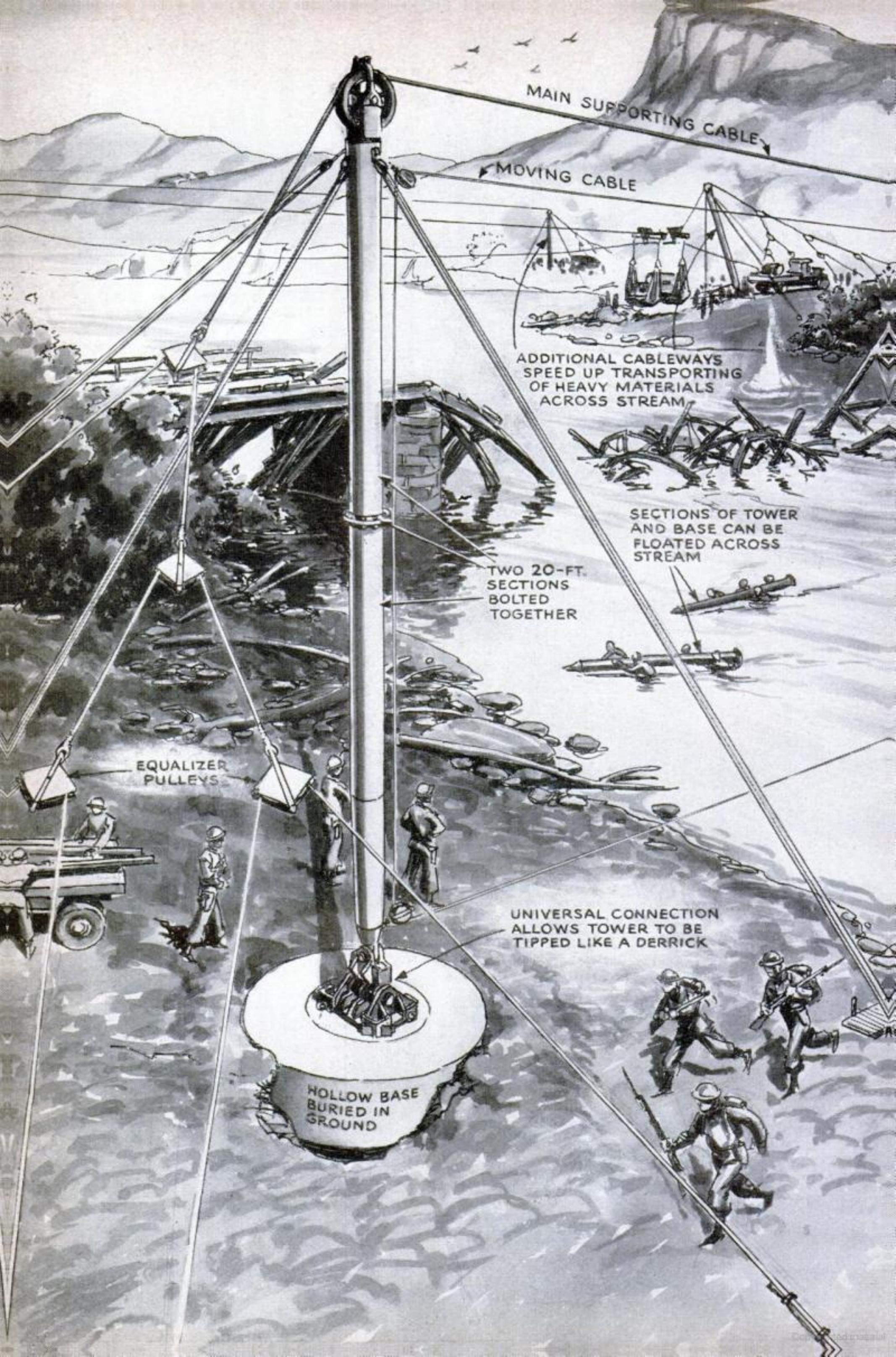
## BRIDGES STREAMS TO CARRY ARMY TANKS AND TRUCKS

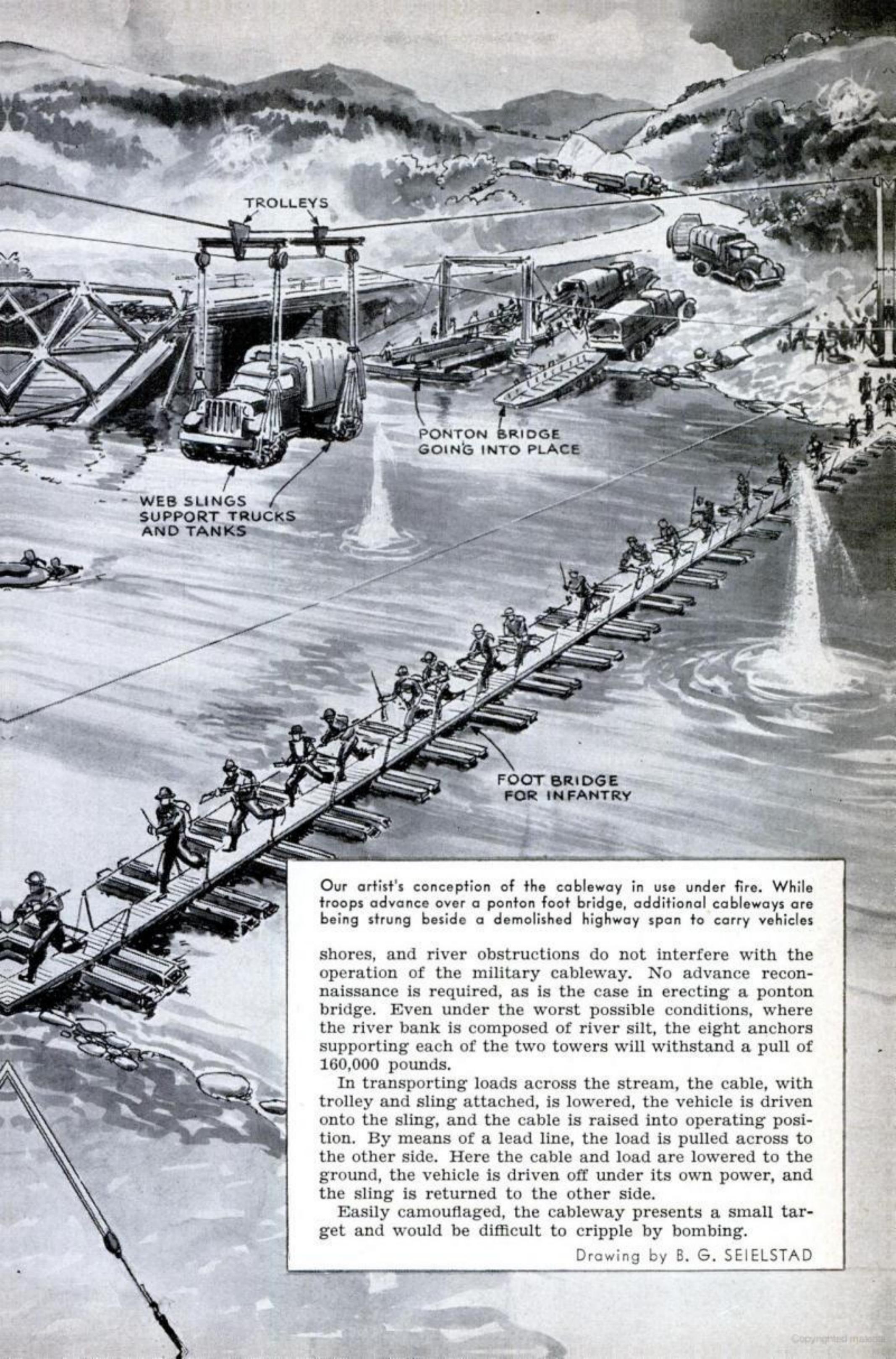
**S**WIFTER transportation of U. S. Army trucks and tanks across rivers and ravines is made possible by a compact portable military cableway invented by Lt. Col. R. B. Lord. In three hours, 13 skilled men, with the help of 40 unskilled ones, can erect the 14-ton cableway and have loads up to 13 tons riding across its 1½-inch steel cable at the rate of one every four minutes.

The breaking strength of this 750-foot cable is 240,000 pounds. The trucks, supported by it, cross the stream or gorge at a speed of 15 miles an hour. By throwing a series of such cableways across a river at intervals, a tremendous amount of material can be transported across without causing the bottlenecks created by pontoon bridges, in which piled-up troops and material offer a tempting target to enemy artillery and bombing planes.

A truck and trailer are all that is required to transport the complete cableway along roads to the scene of operations. The 40-foot steel towers are constructed in 20-foot sections to facilitate transportation. Internal air compartments in these towers, and in the bases on which they rest, permit them to be floated across streams for erection on the opposite banks. By placing two cableways together and using them as a unit, loads up to 27 tons can be carried. The cost of a complete cableway is only about \$4,000.

Flood conditions, shallow





Our artist's conception of the cableway in use under fire. While troops advance over a ponton foot bridge, additional cableways are being strung beside a demolished highway span to carry vehicles

shores, and river obstructions do not interfere with the operation of the military cableway. No advance reconnaissance is required, as is the case in erecting a ponton bridge. Even under the worst possible conditions, where the river bank is composed of river silt, the eight anchors supporting each of the two towers will withstand a pull of 160,000 pounds.

In transporting loads across the stream, the cable, with trolley and sling attached, is lowered, the vehicle is driven onto the sling, and the cable is raised into operating position. By means of a lead line, the load is pulled across to the other side. Here the cable and load are lowered to the ground, the vehicle is driven off under its own power, and the sling is returned to the other side.

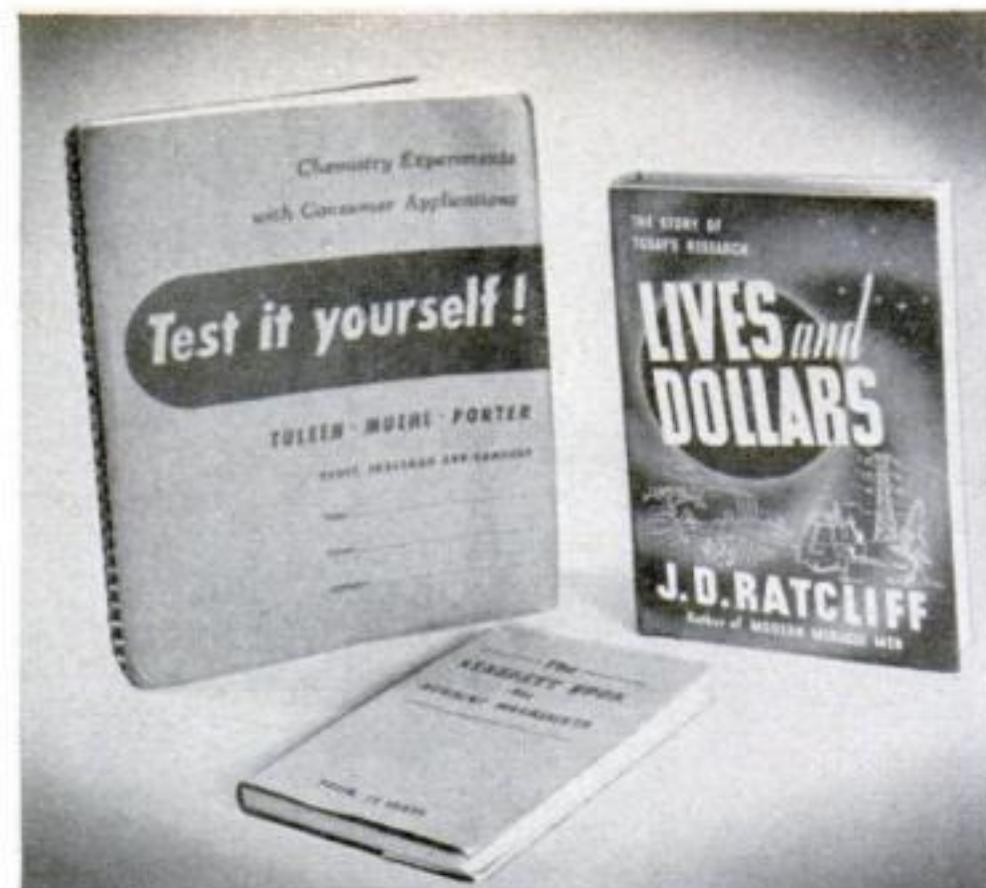
Easily camouflaged, the cableway presents a small target and would be difficult to cripple by bombing.

Drawing by B. G. SEIELSTAD

# Book Review

**HOW CAN YOU TELL** if food has been adulterated? Judge the quality of paint? Determine the wearing ability of linen and cotton? Test fuel oils? Remove stains? Neutralize acid soil? Dozens of practical questions like these, with their answers, make "Test It Yourself!" (Scott, Foresman and Company) an attractive course in home chemistry. Instructions are given for 70 experiments, with condensed explanations of the chemical principles involved, although the manual is intended for use with a standard chemistry text for fuller understanding of the subject.

**EXCITING RESEARCH ADVENTURES** in medical and other fields—some that have made headlines, others that have not—are dramatized in "Lives and Dollars" (Dodd, Mead & Co.). In one of many striking incidents, hundreds



of thousands of CCC boys volunteer to give pneumonia vaccine a mass test.

**PUBLISHED BY A LEADING TOOL FIRM** (The L. S. Starrett Co.), "The Starrett Book for Student Machinists" is a pocket-size encyclopedia on shop methods. It explains developments as up-to-date as classifying metals by spark testing. There are 30 reference tables.

## Cockpit Armor, Light and Tough, Protects Pilot from Bullets

SEEKING a lightweight armor of adequate strength to protect airplane pilots against the machine-gun fire of other planes, the Breeze Corporations, Inc., at Elizabeth, N. J., has developed a new method of production which appears to meet the mark. The essential details of the process are se-

cret, but the armor plate turned out is lighter than most other plate in use, and yet has unusual toughness and strength. In tests it has been found to repel bullets fired from .30 and .50 caliber machine guns at close range, which pierced heavy steel frames that supported it.

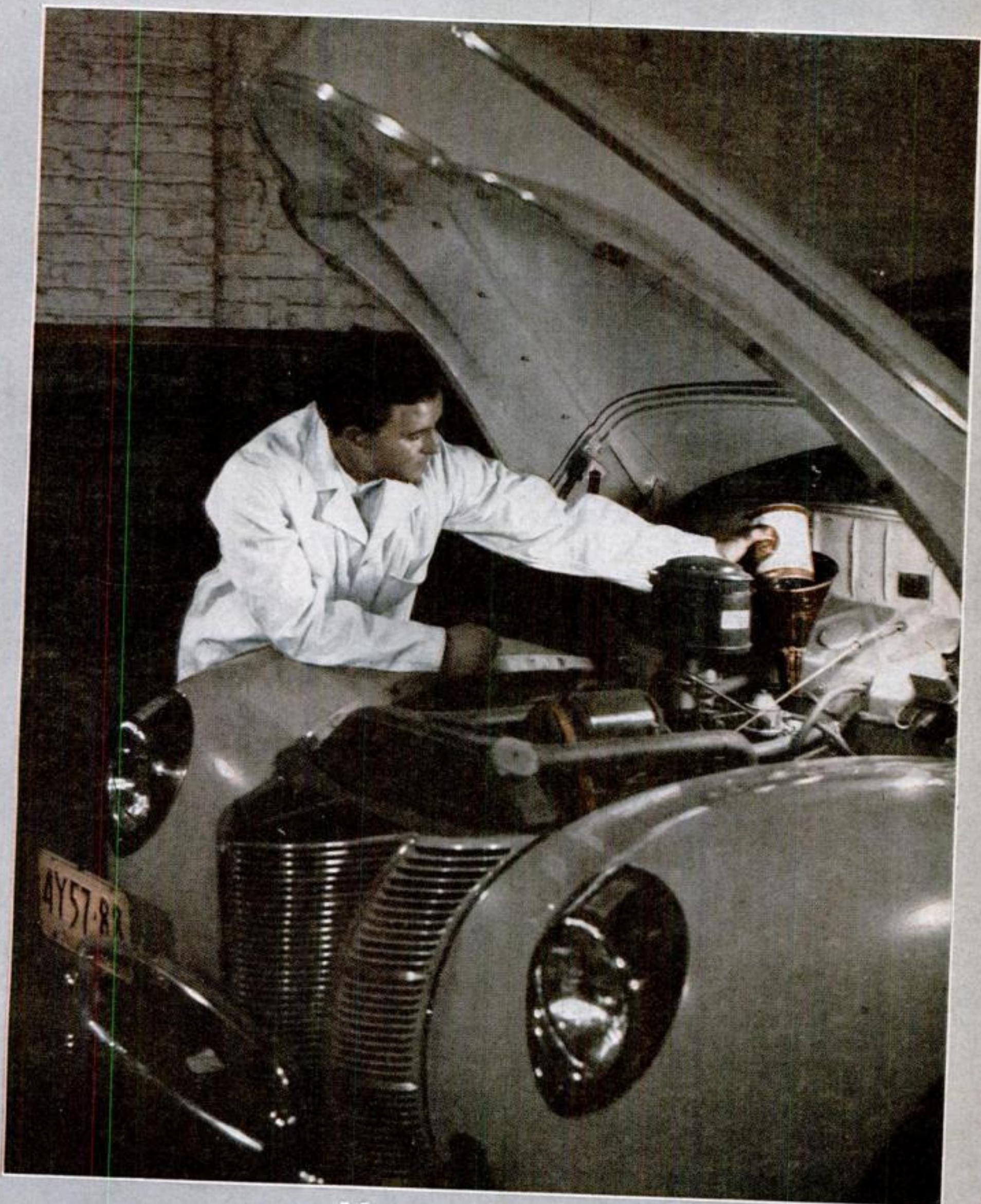


New armor plate, left, was dented but not pierced by .30 caliber machine-gun fire which, however, put holes in the heavy steel frame

The photo at the right illustrates how a pilot would be protected by the lightweight and very tough armor plate as he sat at the controls in the plane's cockpit



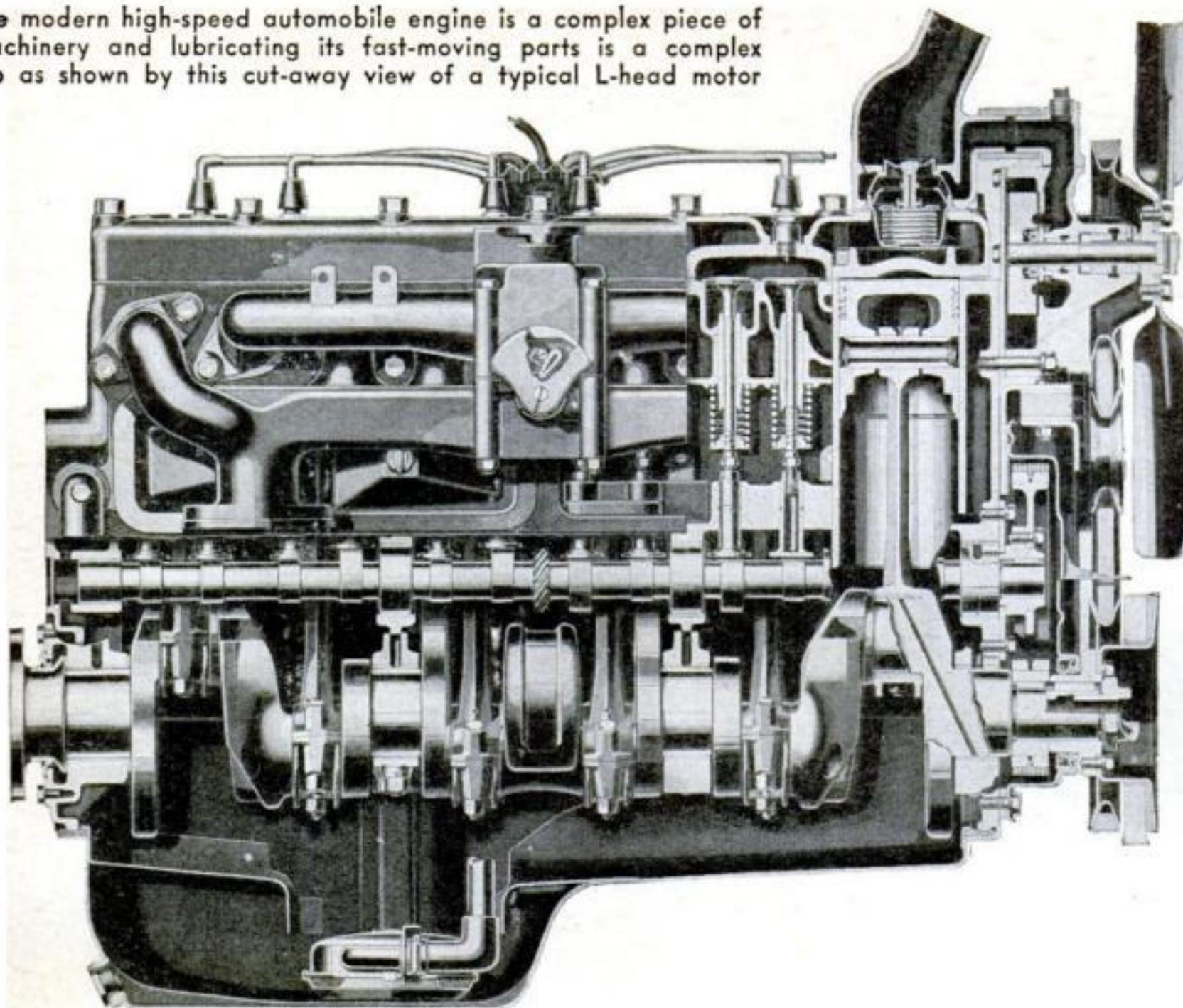
# AUTOS



Your Car's Oil System

NEXT PAGE

The modern high-speed automobile engine is a complex piece of machinery and lubricating its fast-moving parts is a complex job as shown by this cut-away view of a typical L-head motor



## Modern Lubrication Saves Your Engine

By SCHUYLER VAN DUYNE

EVERY time you step on your car's self-starter, disaster is prevented by a layer of oil perhaps only a couple of molecules thick. If the layer were not where it should be—between the friction-bearing surfaces and the "journals" that revolve in them—your engine would soon "seize."

That is what engineers call it. To anyone who has heard it happen in a high-speed automobile engine, it sounds like an ocean liner's anchor chain dropping into an empty steel tank. It simply means that, because of lack of oil, journals and bearings have rubbed directly against each other, become intensely hot, melted, and finally fused together into a single metallic mass of junk!

You might ask why, if oil simply cools bearings, you cannot use plain water. The answer is that water is so thin and lacking

in "body" that it would quickly run out from between the metal surfaces. To quote the engineers again, oil has "viscosity," or body—the ability of its molecules to resist attempts to separate them from each other. And this ability is most powerful when oil is spread thin, as within a friction bearing.

To get oil into bearings, recover it, clean

How oil, in many car engines, flows under pressure through a main bearing and a hole drilled in the crankshaft to a connecting-rod bearing



it, and recirculate it, requires an ingenious mechanical circulation system not unlike that of the human body. There is in nearly every automobile engine, for example, an oil pump corresponding to the heart, an oil filter corresponding to the lungs, and a network of metered holes and pipes corresponding to the human blood vessels and arteries.

In several of the illustrations accompanying this article, well-known automobile engines are shown in phantom view to reveal their lubrication systems. You will see that each has an oil pan below it serving as a reservoir.

When your engine is running, oil is constantly being drawn from this reservoir by a powerful, gear-type pump that might be likened to two revolving doors set close together. As they turn, the outside edges pull oil through the fitted opening. The meshing edges effectively block oil from flowing back again.

On the lower end of the intake pipe there is usually a bell-shaped device, containing a fine-mesh screen, which dips well down into the oil pan. Oil drawn up by the pump is pushed through the pipes and drilled holes that honeycomb the engine. Since the speed of the pump changes the oil pressure, an escape valve that opens against a spring serves to maintain the pressure at nearly constant level.

The bearing surfaces lubricated by your engine oil are the crankshaft and the connecting-rod bearings, the camshaft bearings and cam surfaces, the piston pins, the cylinder walls, piston surfaces and piston rings, the valve lifters and stems, the valve push rods and rockers in valve-in-head engines, the timing gears or chain and sprockets, and at least part of the distributor shaft.

You may mark down as a rule that the oil goes under pressure to certain of these bearing surfaces. These are the crankshaft and camshaft main bearings, and the rocker arms of valve-in-head engines. On most cars, oil is piped through the whirling crankshaft, by means of drilled passages, to the connecting-rod bearings. Such oil enters the shaft at the main bearings under pressure. On Chevrolet engines, the con-

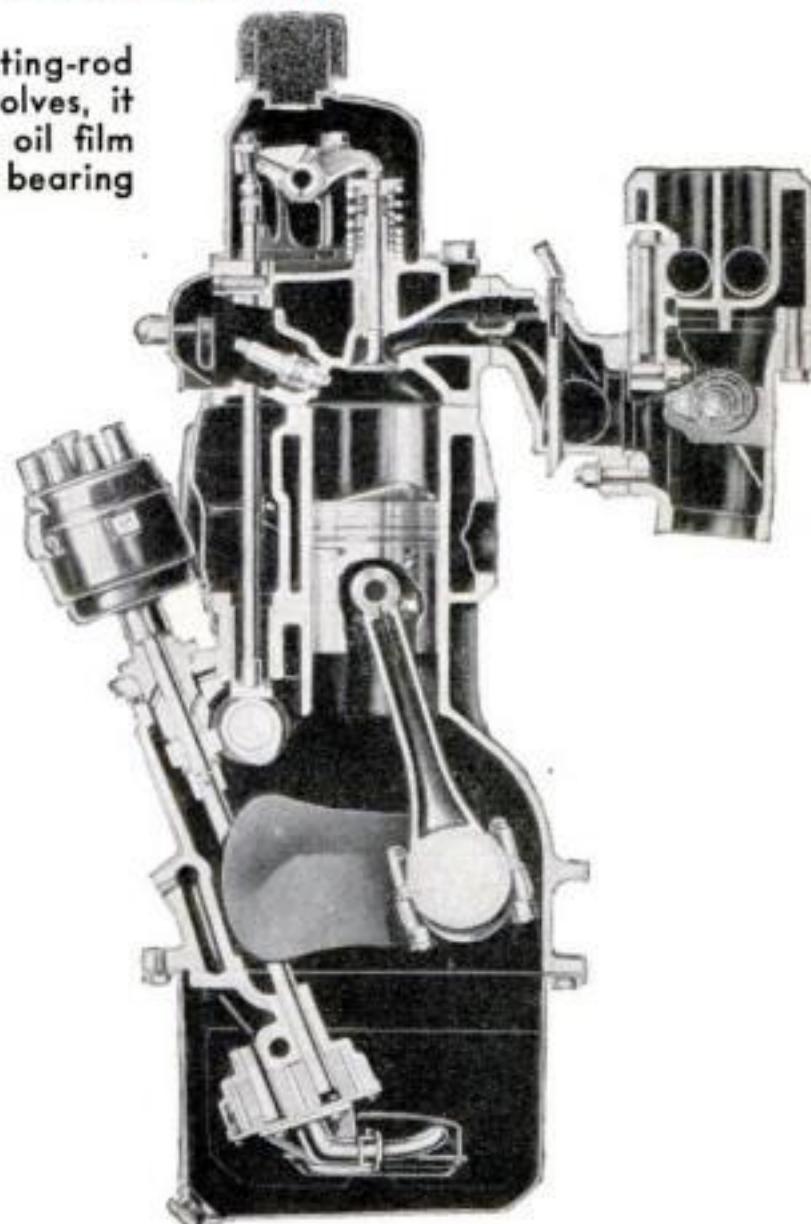
necting-rod bearings have downward-extending cups that intercept streams of oil with great force for their lubrication. On Pontiac engines, even the connecting rods are drilled from end to end. Oil from the lower bearings is thus carried up to the piston pins which, on other cars, are lubricated with spray thrown off by the crank throws. Such spray, on all cars, lubricates and helps to cool the pistons and piston rings, as well as the cylinder walls.

On engines of the L-head type, in which the entire valve mechanism is on one side, oil spray is largely depended upon to lubricate valve stems and guides, as well as the lifters that ride in tight-fitting sleeves above the cams. On valve-in-head engines, oil from the rocker-arm bearings flows down over the push rods and lifters.

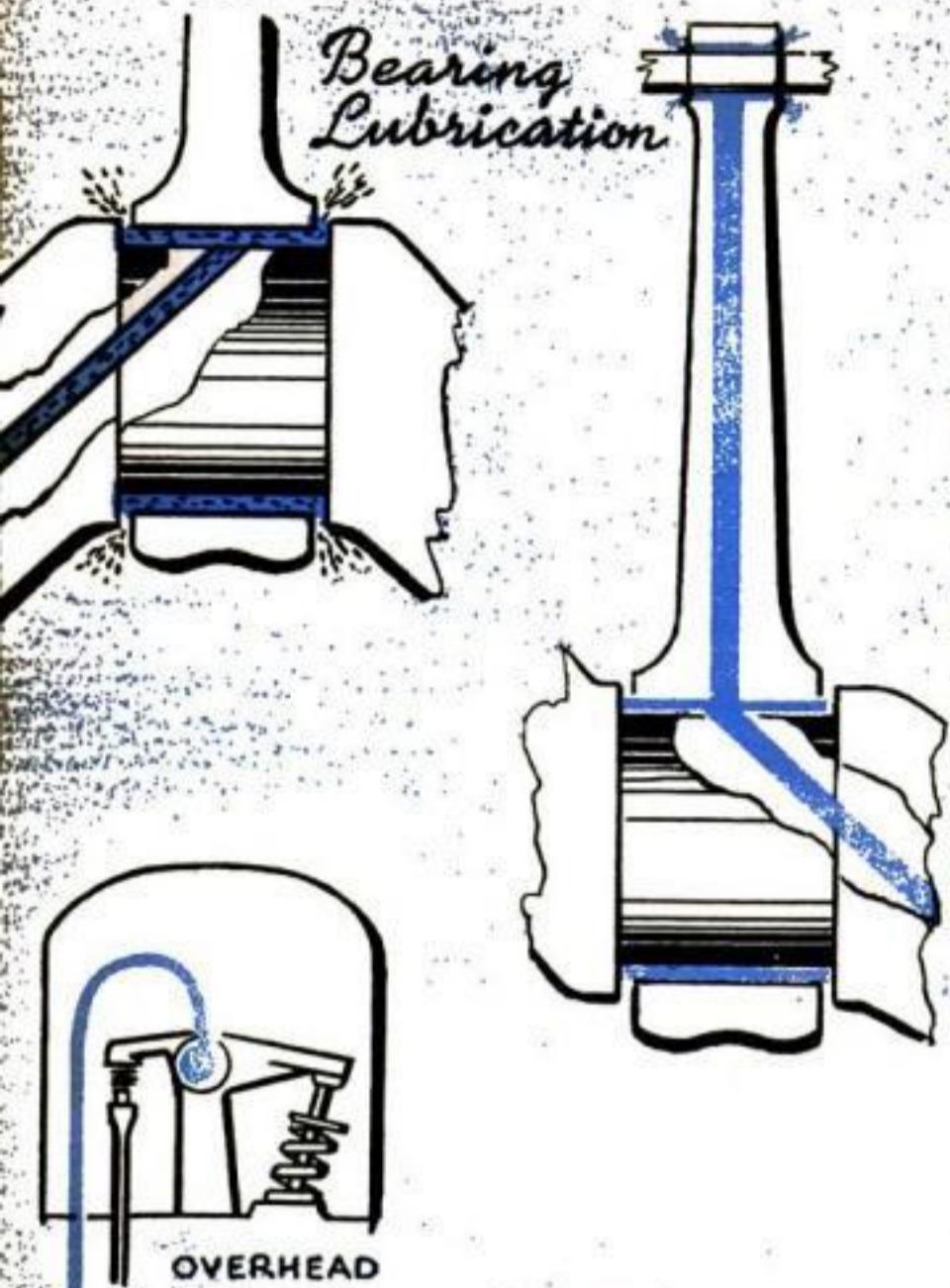
From its course through the engine, some of the oil is by-



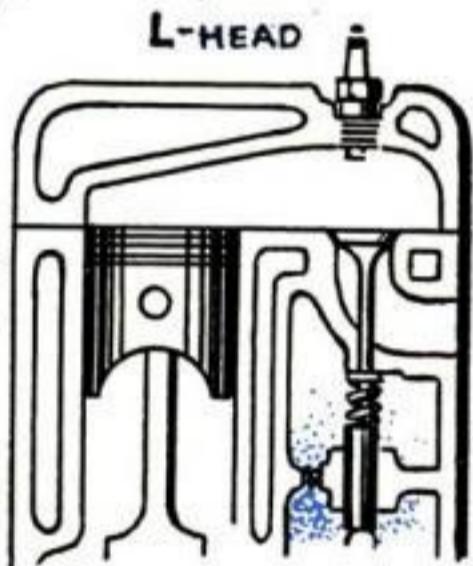
Oil circulation in a connecting-rod bearing. As the shaft revolves, it pushes a crescent-shaped oil film around the surface of the bearing



Cross section of an overhead-valve motor showing important bearings which oil must reach. At bottom of crankcase, a common type of oil pump is seen



### Valve Lubrication



passed to the filter—standard equipment on most cars. Here it is forced through fine-mesh fabric packing which removes even the extremely fine particles of dirt, sludge, and metal that inevitably find their way inside your motor.

Today's cars would not last as they do without the important crankcase ventilation system built into all of them. In this, air enters the oil-filter cap, which contains a dust filter, and passes down into the crankcase. There, the clean air is whirled by the revolving crankshaft so that it "washes" the flying engine oil free of harmful moisture and acids that form during engine operation, and which ordinary oil filters would not remove. When it has done its work, the circulating air passes through a trap which returns any oil mist it may have picked up to the crankcase, and out through a pipe or "breather" tube.

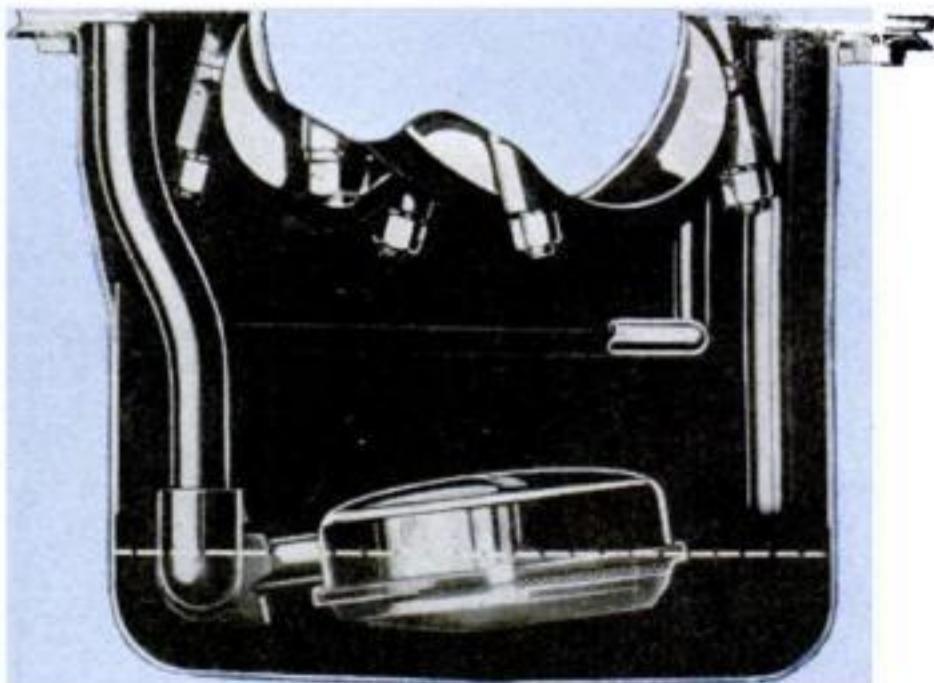
Sealing in your engine oil is one of the critical engineering problems which car builders have solved. In the "top" of your motor, piston rings prevent oil from passing into the combustion chamber, and valve guides, closely fitted to the stems, serve the same end. Where metal engine parts are joined, as the oil pan to the upper crankcase, and the timing-gear and valve covers to the cylinder block, cork or composition

Two ways of lubricating piston pins—by spray and by drilled connecting rods—are shown at left, top. Spray from all bearings helps to cool pistons and lubricate cylinder walls. Below, the oil system for overhead valves, in which oil is carried to the rocker arms, and for L-head engines, which utilize spray

## TWO NEW BUILT-IN OIL-FILTERING DEVICES



**BUILT-IN FILTER.** Pontiac's arrangement of traps, filters, and baffles is designed to clean the oil before it enters the pump



**FLOATING INTAKE** on Chrysler cars takes oil from beneath surface yet not from pan bottom

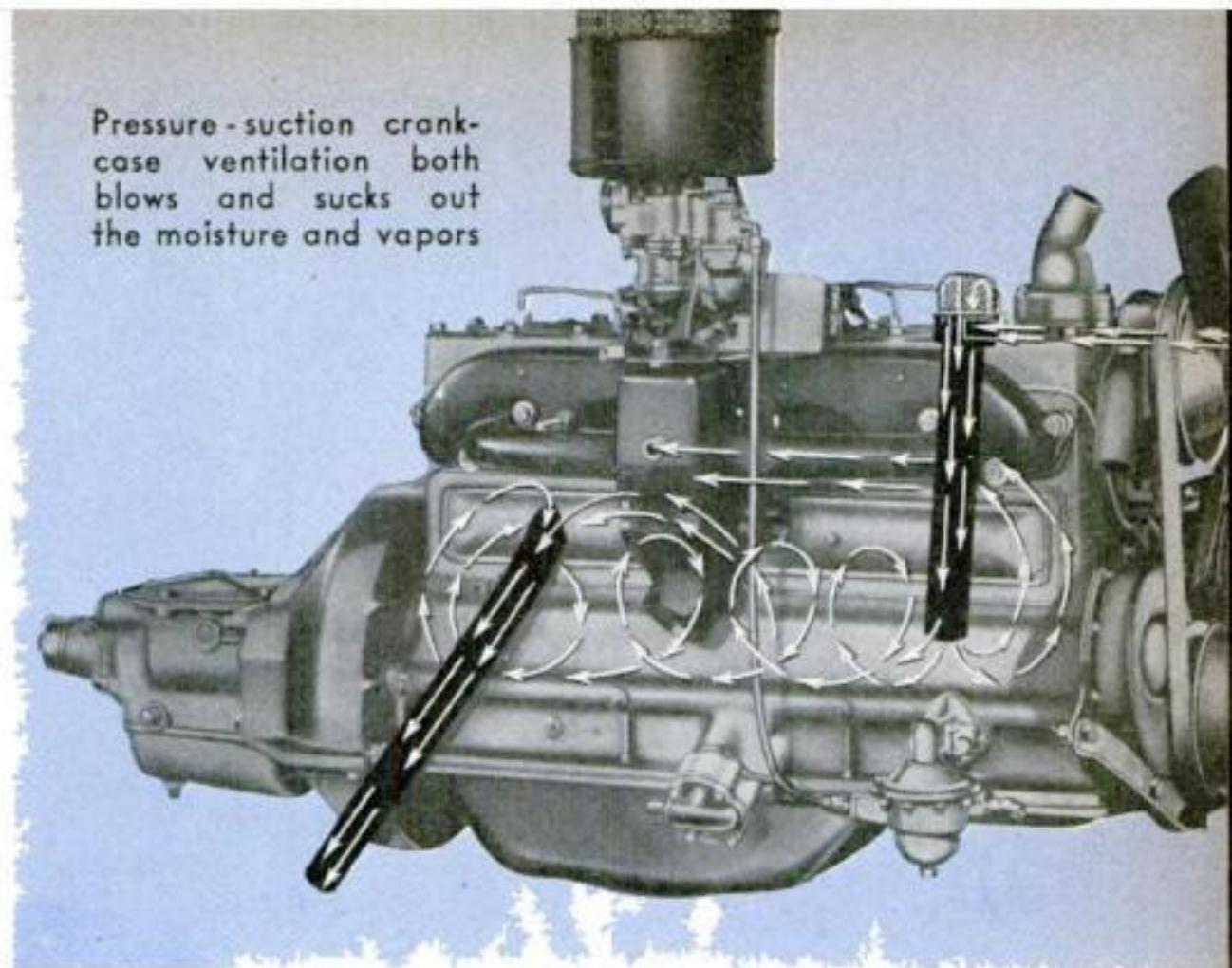
gaskets seal the cracks. And where crankshaft ends emerge from the engine, one of the most ingenious examples of leakproofing is found. Here, in addition to close-fitting seals that check seepage, a ridge of metal circles each end-bearing journal. Any oil passing the bearing is thrown by centrifugal force to the edge of the ridge and off into a channel. From the channel, an oil duct leads the wayward lubricant back into the crankcase.

On the outside of your engine there are few moving parts to be lubricated, but they are important ones. These are the water-pump shaft which on most cars also turns the fan, the upper section of some distributor shafts, and the bearings of your starter and generator. In addition, there are the carburetor control rods and their links.

Some of these are lubricated by hand with an oil can. On the water-pump and distributor shaft, grease fittings are the usual means of lubricating. Compared with internal engine bearings, the loads carried by most of these are light.

Some of them, and a few inside the engine, are permanently oiled, in Chrysler-built cars, with bearings that are actually made of a special oil-impregnated metal. Developed by Chrysler engineers, the material is also used in the moving parts of a specially designed oil pump which gives higher engine-oil pressure at low engine speeds.

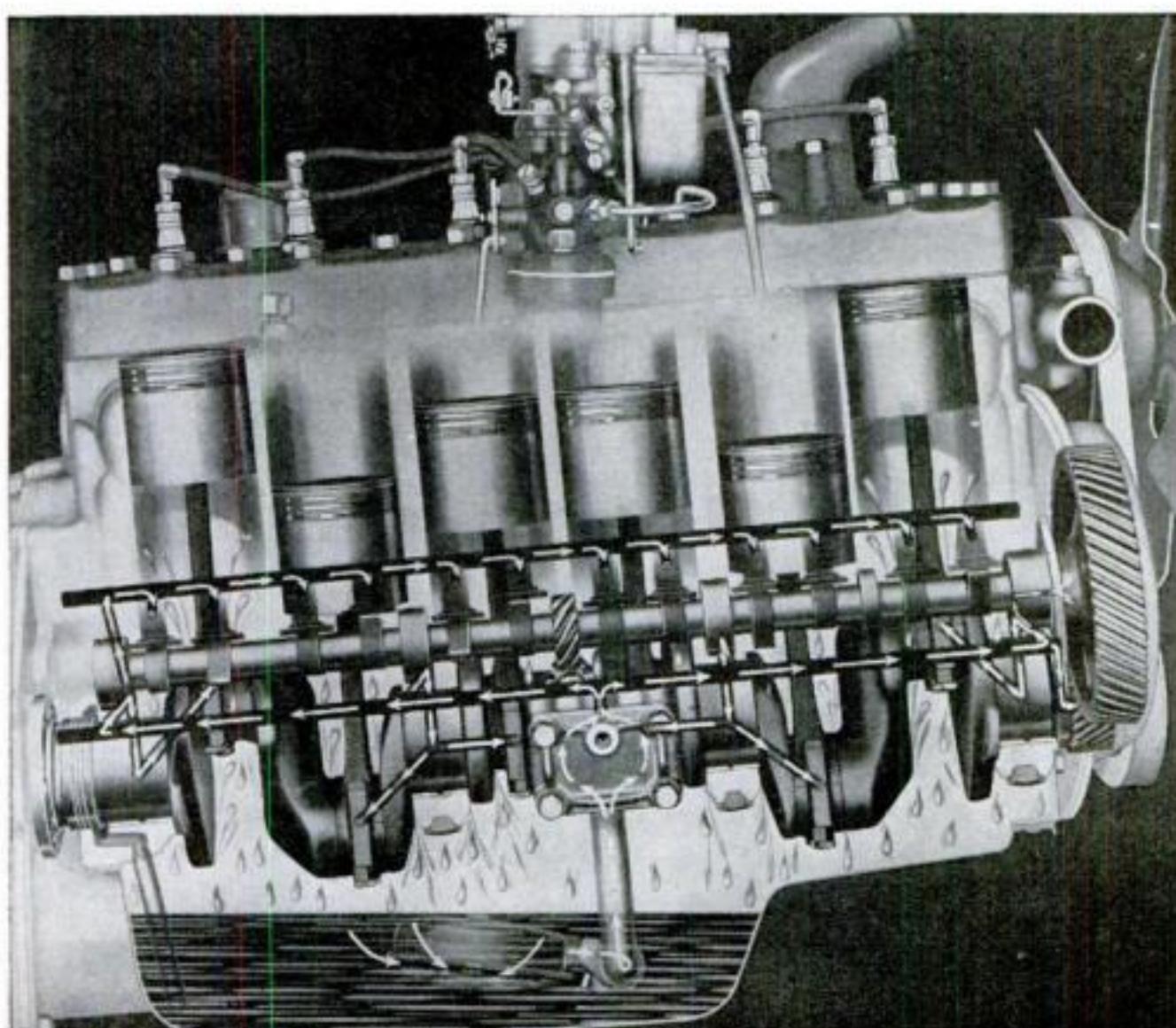
Pressure-suction crankcase ventilation both blows and sucks out the moisture and vapors



Automobile manufacturers have gone to great lengths to make engines lubricate themselves efficiently, but with your purchase of a car, the responsibility becomes yours. There is little left for you to do, however, besides keeping those many close-fitting bearings in your engine in good condition. For when they become loose, oil leaks from them too rapidly. Too much of it then reaches the top of your motor at about the time that piston rings and valve stems also begin to show wear, and oil escapes past the rings and valves to burn up in the combustion chamber. Your oil bills promptly skyrocket.

But you don't have to be an automotive engineer to keep bearings in good condition. Changing your oil, using the proper grade and quality oil, replacing the filter when necessary, and occasionally cleaning the oil-filler breather cap as your manufacturer recommends, will automatically do the best possible maintenance job for you by keeping oil clean and new. Dirt, chemicals, and other impurities then cannot attack and cause wear in the bearings.

And remember that good oil is as necessary as gas and water to your car's long life and efficiency.



Full-pressure lubrication. This phantom view of a six-cylinder engine shows the course of the oil from the intake through the pump to engine bearings

# How To Save Gas

BY KEEPING your car tuned up, and by driving carefully so that you travel the maximum number of miles on each gallon of gas, you can put pennies in your pocket, contribute to national

defense, and be satisfied that your car is doing its best. This is particularly true in sections where a shortage of motor fuel exists. Below are a few hints on what to do and what not to do.

## DO



**STOP SLOWLY.** Coast up to stop signs and traffic lights, letting your motor brake the car as much as possible. In addition to saving gas, this will save tires and brakes as well.



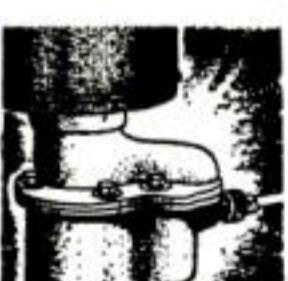
**CHECK SPARK PLUGS** frequently, as well as other parts of the ignition system, to see that they are clean and properly adjusted. A good spark is the life of any motor.



**KEEP BRAKES** properly adjusted. Dragging brakes make your engine work harder, consume more fuel. They are like hidden taxes — taking money away from you where you least suspect it.



**INSPECT FUEL PUMP** and lines for leaks. Seepage from loose joints will account for a lot of fuel over a period of time. Leaks that go unfixed are fire hazards as well as gas wasters.



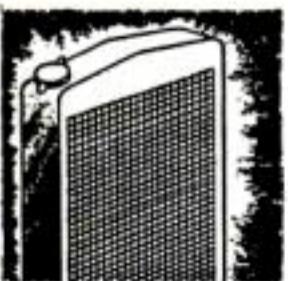
**ADJUST YOUR CARBURETOR** to get the proper ratio of gasoline and air. Too rich or too lean a mixture burns excessive gas. Avoid using the choke more than is necessary.



**GREASE AND OIL chassis** and engine in accordance with the maker's recommendations. Too heavy lubricants drag like cold molasses; too light ones allow friction and wear.



**BUY GAS** that is produced by reputable refineries, and you will have a better chance of getting good mileage than if you gamble with bootleg gas or an unknown product.



**BE SURE** the cooling system is working properly. An engine that runs too hot or too cold wastes gas and wears out faster than one that is kept at the proper temperature.

## DON'T



**DON'T SPEED.** Gas mileage drops sharply as speed goes above 40 miles an hour. At 60 you are practically throwing gas away. Take your time and you'll get there on less gas.



**PARKING IN THE SUN** is wasteful because gasoline tends to evaporate rapidly when it is hot. Park your car in the shade and your gas won't vanish into thin air so fast.



**PUMPING** the throttle feeds more gas into the engine than it can consume economically. Besides wasting gas, this practice is hard on running gear and causes needless tire wear.



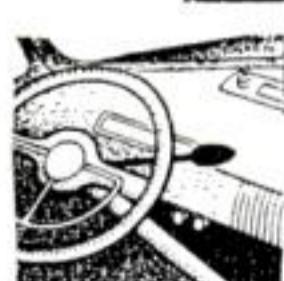
**DON'T FILL** your tank to the brim. Bumps and turns may slop it out if the cap isn't tight. Attendants should avoid spilling, and some room should be left for expansion.



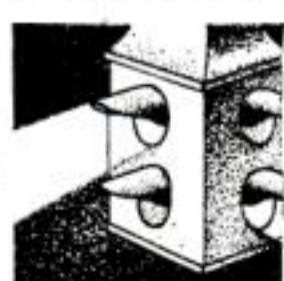
**KEEP TIRE** pressures up to the proper point. The car may ride better with soft tires, but 14 percent too little air will decrease your miles per gallon by 2½ percent.



**AVOID QUICK STOPS.** By anticipating traffic lights and other stopping points, you can get along on 50 percent less gas than you will use if you are a brake rider.



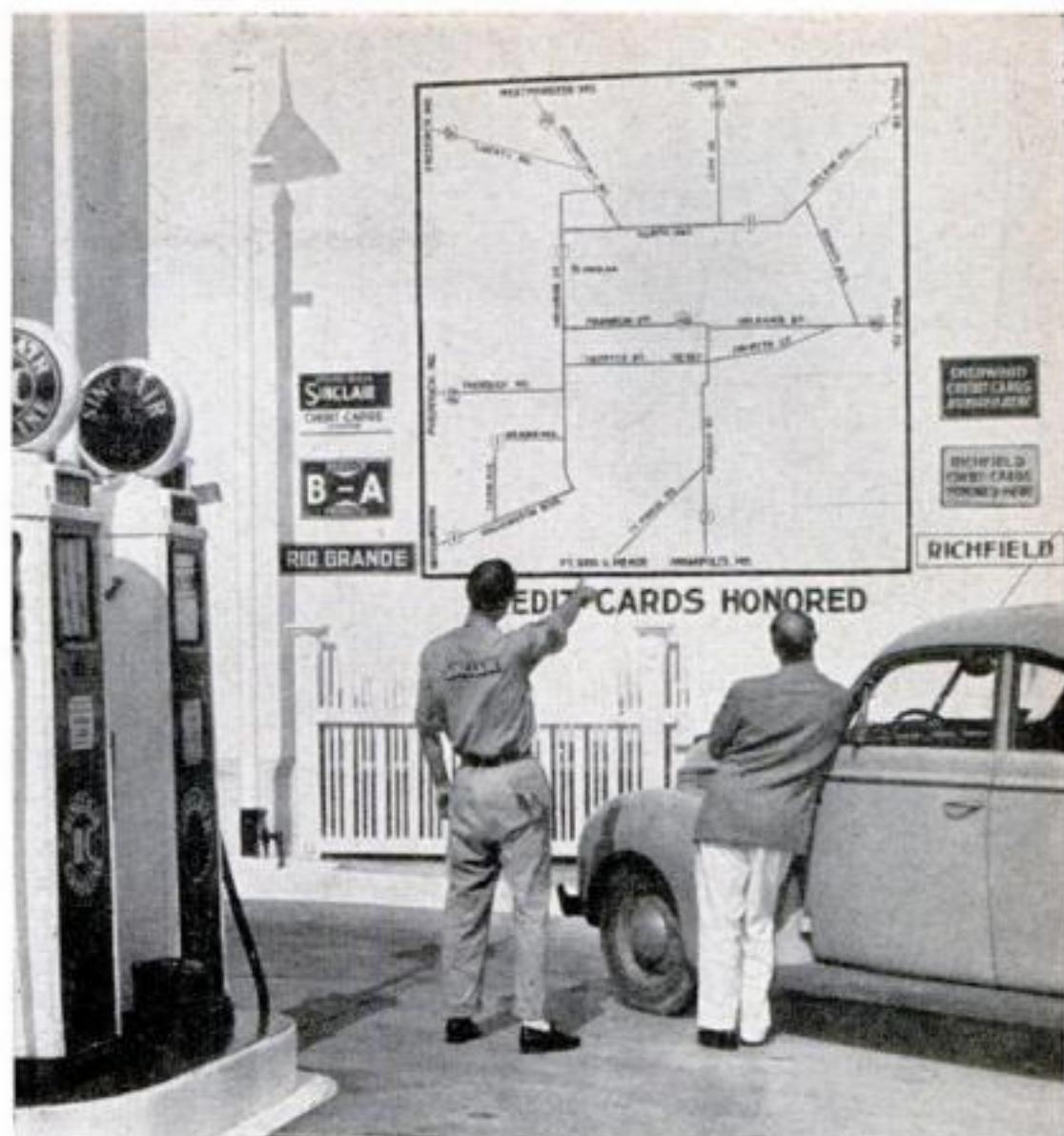
**SHIFT INTO HIGH** as soon as the car reaches a reasonable speed. Don't ride in second and don't "force" it in the lower speeds. Trying to overcome inertia in a hurry is expensive.



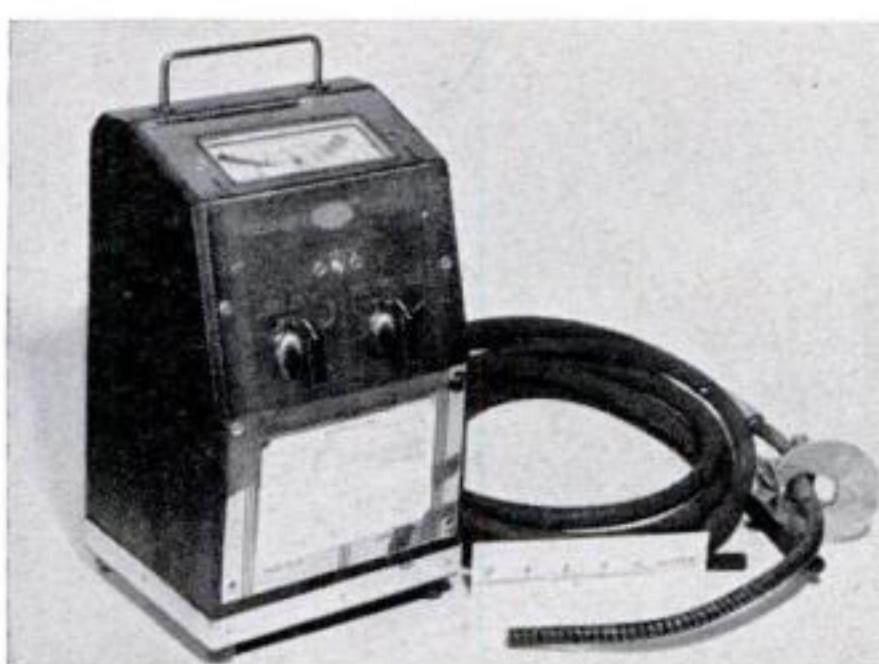
**JACK-RABBIT** starts when you get a green light are real gas wasters. They are hard on tires too. Let the car pick up slowly and both car and gasoline will last longer.

## Auto Ideas

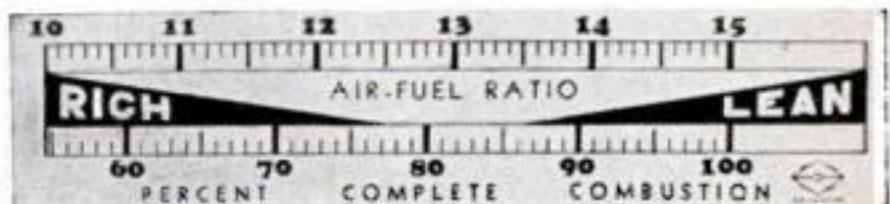
PAINTED ON THE WALL of a filling station in Baltimore, Md., is the large-scale map of the city shown at the right. Located at Baker and Monroe streets, the station is on U.S. Route 1, a main north-and-south highway through the Eastern States. After answering what seemed millions of questions from motorists who wanted to know how to get places, the station operator decided he could save time and still give his customers directions if he didn't have to pull out a map every time. The one on the wall, showing through routes and principal streets, was his method of solving the problem.



WINDSHIELDS and other fixed panes of glass in automobiles are apt to develop leaks around the edges after they have been exposed to sun, rain, sleet, and snow, no matter how well they were set when the car was new. Frequently leaks are not bad enough to warrant removing the glass to fix them. For such cases, a sealer has been developed and is sold in a tube. It dries rapidly, forming a transparent bead along the edge of the glass. It will stick to wood, glass, metal, or plastic. Tubes of the sealer are available in one-ounce and 5 1/4-ounce sizes.



As a check on gasoline waste, the tester above is attached to the exhaust pipe with the motor running for a reading on the indicator at right



We'd like  
about 200  
traffic  
fatalities  
next year



Okay,  
you're  
the one  
to  
decide

Are you guilty of these—

## 12 COMMON DRIVING FAULTS



1 FAILURE TO SIGNAL. Sudden changes in speed and direction don't give the other fellow much of a chance to miss you



3 DISCOURTESY. The road hog is a danger to himself as well as pedestrians and the other drivers on the road



2 POOR JUDGMENT. Trailing another car too closely or passing on a hill or curve are invitations to trouble



4 IMPROPER TURNS may save time, but they take their toll in smashed fenders, jagged nerves, and broken bones

## Drunk in car-gates ajar



**5** ALCOHOL doesn't mix with cars, and the same goes for drowsiness, illness, and general nervousness

What's the hurry?  
When we get there  
we'll just



**6** WEAVING IN TRAFFIC. Driving in the wrong lane. Swerving. A straight line is still the shortest distance between points



**7** DRIVING TOO FAST for road conditions. Traffic, road surface, weather, and visibility should control your speed

**8** OVERCONFIDENCE in your ability to "stop on a dime," puts a big load on your car's tires and brakes

And how about these?



**9** INATTENTION. Driving a car is a full-time job that leaves little time for rubber-necking.

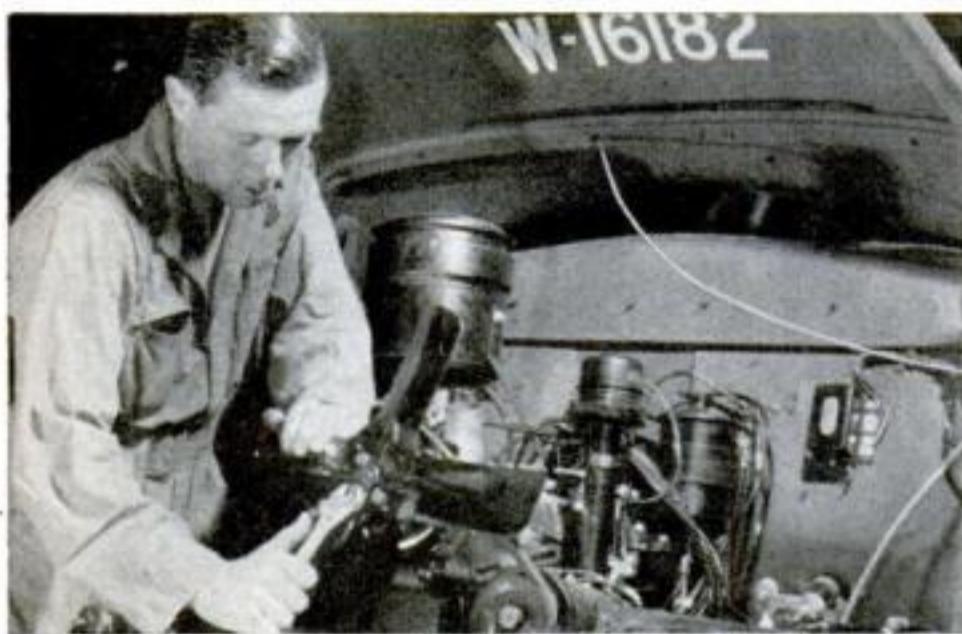
**10** POOR USE OF HEADLIGHTS. Failure to dim your lights when passing an oncoming car. Use of "brights" in city streets.

**11** FAULTY CAR. Lack of proper equipment. Failure to have brakes, lights, tires, and motor checked periodically.

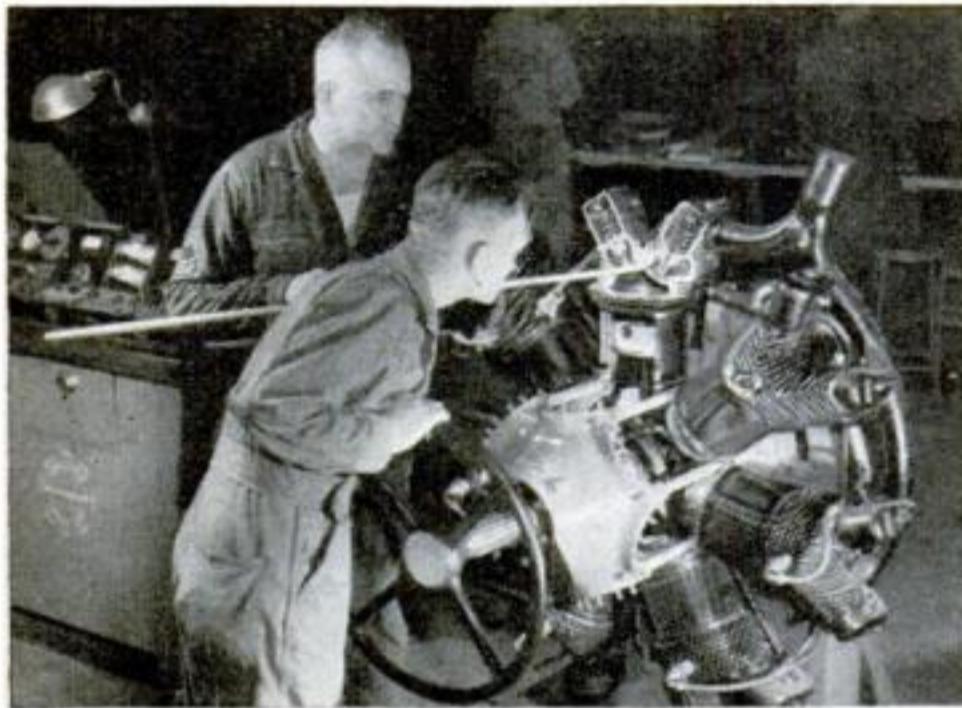
**12** OVERUSE OF HORN. Don't substitute noise for skill. Use your foot on your brakes instead of your finger on the horn button.

To make your driving happier and safer, check your driving habits against these faults

# Motorization Means More Mechanics...



A student mechanic at the Quartermaster Motor Transport School, Holabird Quartermaster Depot, Baltimore, Md., tries his hand at tightening a fan on an Army car



With a cut-away model of a radial gasoline engine, an instructor shows a rookie what makes it click. Visual instruction and demonstration lead the way to practical application in school shops

These boys are learning about hub assemblies. They take down and assemble various units such as engines, transmissions, differentials, fuel pumps, and distributors until they can almost do it with their eyes shut



IT TAKES more than gasoline and oil to keep the Army rolling these days. Mechanics are needed, hundreds and thousands of them. Not just ordinary mechanics, but men who have been trained in the intricacies of four-wheel drives, high-torque differentials, constant-velocity universal joints, and the thousand and one other special items that make the U.S. Army vehicles just about the best in the world.

To fill this need, the Army's Quartermaster Motor Transport School at the Holabird Quartermaster Depot, Baltimore, Md., along with other similar schools, has been expanded to many times the size it was a couple of years ago. Then it was turning out classes of 150 enlisted men every nine months, with small officers' classes in the spring and fall. Now, with new buildings and equipment, the enlisted students number more than 1,000, with a correspondingly increased number of officers, and classes are being graduated every month.

Some of these boys who are being trained to maintain the Army's more than 200,000 tanks, cars, trucks, and motorcycles were expert commercial mechanics before they signed up. Now they are learning how the Army does

# ...So the Army Enlarges Its Auto School

it. The others are lads with a flair for mechanics and a head for learning. All were picked by commanding officers of units of all branches of the service, from posts all over the U. S., some for training in the one-month basic course, others for one of the three-month specialist courses, and some for both.

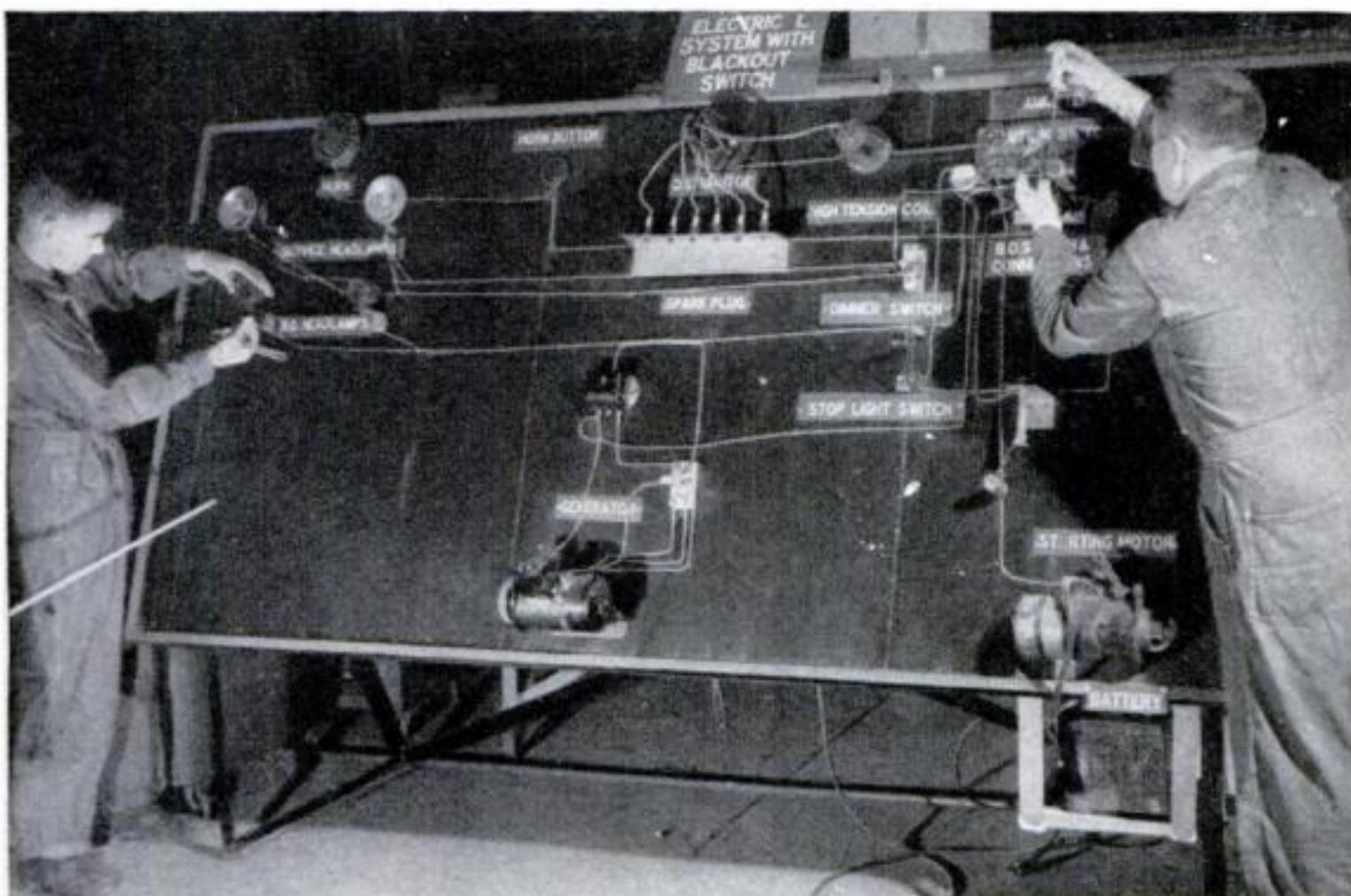
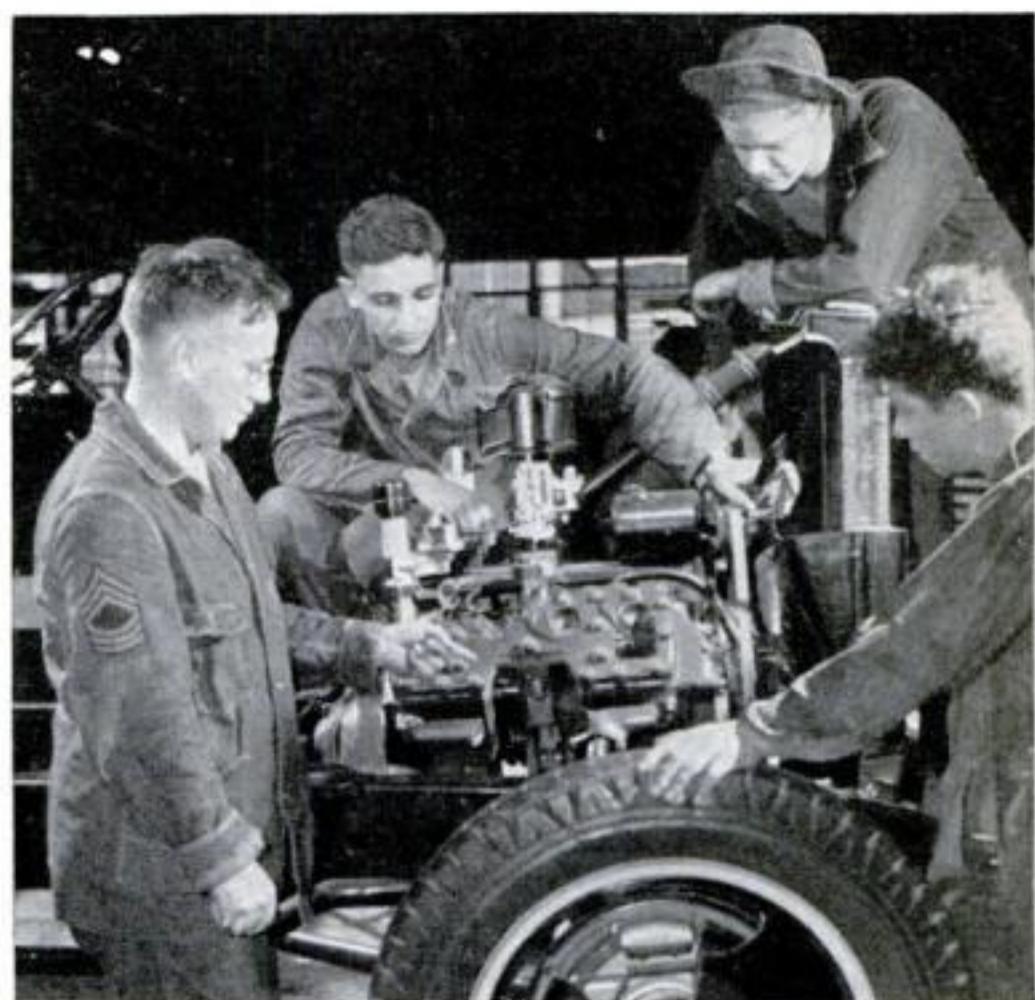
In the basic course they learn the principles of internal-combustion engines, gears, and suspension systems, so that they will be able to do simple maintenance work such as greasing, changing spark plugs, and making minor repairs.

The specialist courses cover many fields. They include such trades as welding, blacksmith work, sheet-metal and body repairing, upholstering, and machine-shop work.

The school works on a basic theory of explanation, demonstration, and application. Students start off with classroom work with civilian or Army instructors, with one instructor for every 20 students. With diagrams, movies, and lectures the instructors show what makes an automobile go, and what has to be done to keep it going. Then the students move into the

huge shops, where pieces of cars, trucks, and motorcycles are scattered all over the place. There the instructors point out and demonstrate the things discussed in the classrooms.

The third step is to have the students take down and assemble units such as engines, transmissions, differentials, fuel pumps, and distributors until they are

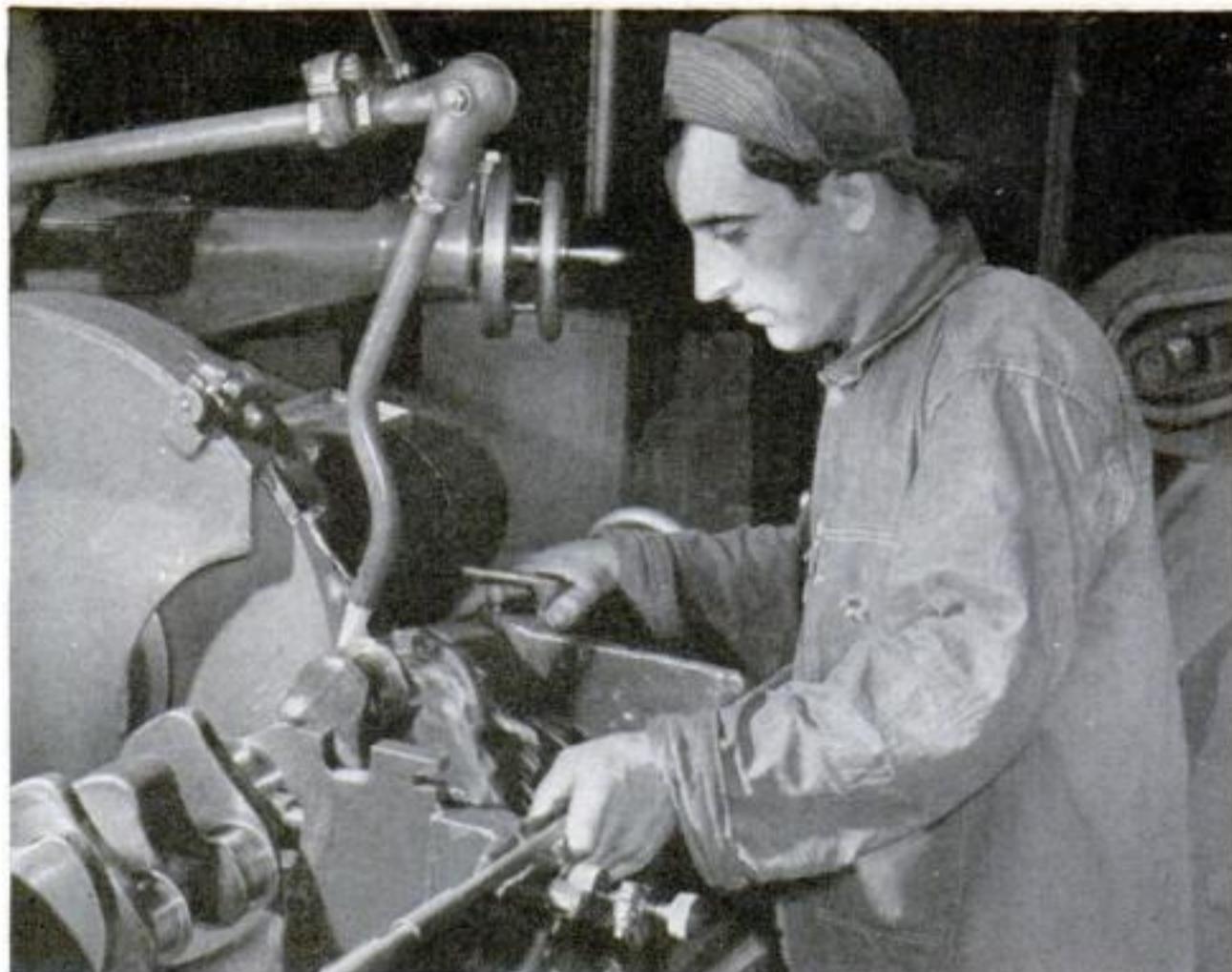


Internal-combustion engines supply motive power for the modern army, so they get a lot of attention at Holabird. Students put their studies to practical use repairing vehicles in actual service

Diagrams like the one at the left, with the parts mounted on it, help students to understand an ignition system. Movies and lectures also aid in initiating the tyro into the mysteries of automotive design

Use of shop tools is made part of the course. This soldier, learning to grind crankshaft bearings, knows that he is acquiring skill which will bring him promotion while he is in the Army, and equip him with a valuable trade when he returns to civilian life

Running a milling machine seems like a far cry from the manual of arms. However, enlisted men at the school don't escape from Army discipline. They are organized in companies and each man has to carry his share of Army chores such as kitchen police and cleaning up the barracks



almost able to do it with their eyes closed.

Before they are considered finished mechanics, the students are given stiff practical tests to see how well they have learned their lessons. These are problems of the kind that a soldier in the field might be faced with. A student in motor maintenance, for instance, will be assigned to an engine which has been put on the blink in some unobtrusive way. Maybe the fuel pump has been plugged with a tiny bit of cotton, tucked away where it will be hard to find. Or a distributor has been timed just far enough off the proper point so that an engine will run, but not well. Possibly valve tappets will have been loosened, or the cooling system blocked. Whatever it may be, the student assigned to a particular job is supposed to find the trouble and correct it, working against time.

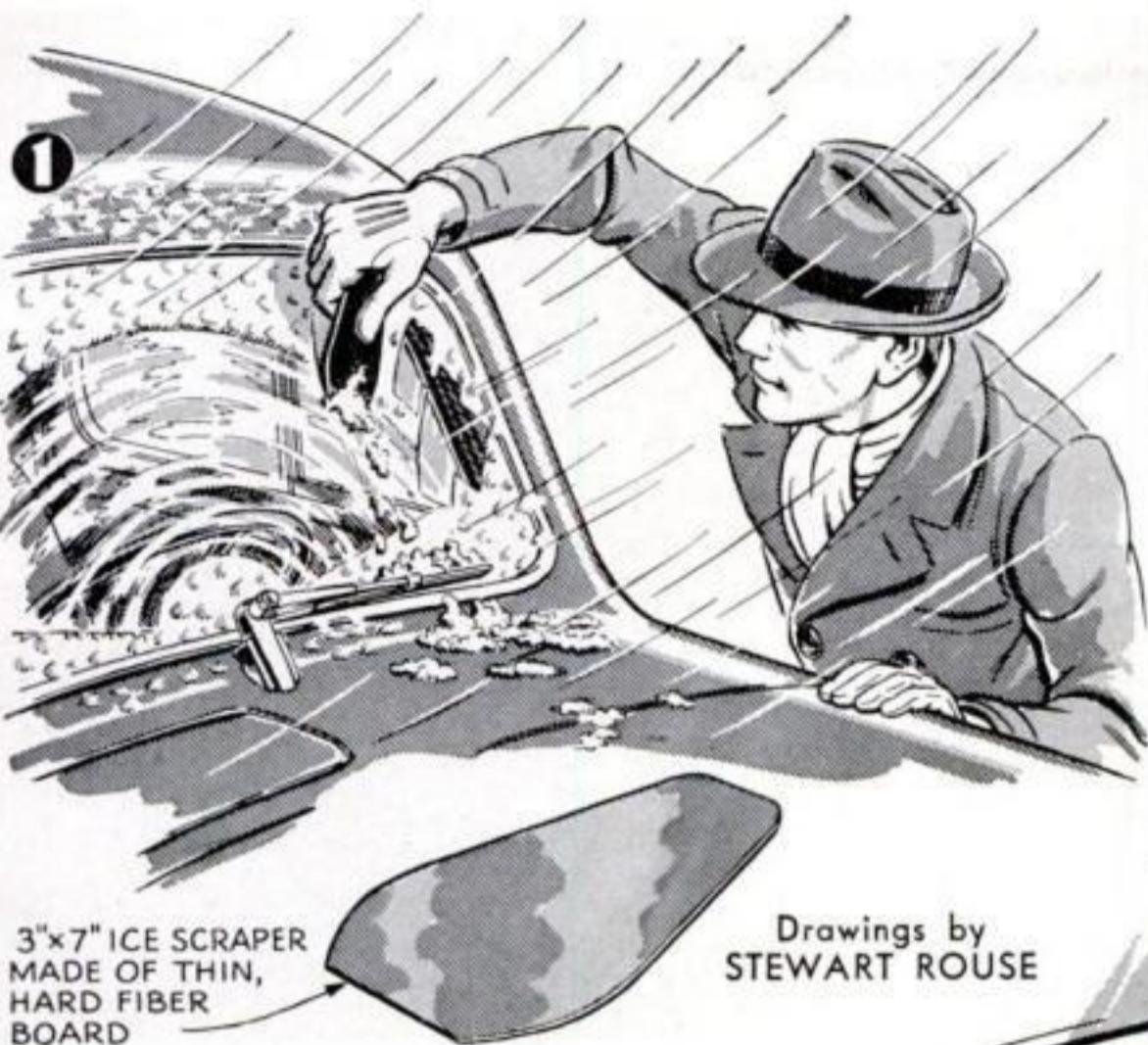
The more adept of the students are singled out and given special training that will enable them to act as foremen, or to train other soldiers when they return to their camps, because even with the increase in school activities, the Army can't hope to train mechanics in the schools as fast as they are needed. Officers go through the same courses as enlisted men in many cases; in others they are taught more about supply and administration after they have their basic training.

A good portion of the work of the students is put to a double use. Quartermaster Corps vehicles in need of repairs are sent to the school shops, where the students, under the guidance of their instructors, make necessary repairs, learning while they are working.

Even though they are studying seven hours a day, six days a week, and frequently have homework to worry over in the evenings, the boys don't get out of Army discipline. Students at the school are organized into companies and each soldier has to do his share of kitchen police, cleaning up the grounds and barracks and other chores.

But most of them like it. They are learning things that may help them make a living when they go back to civilian life, and that will aid them in getting promotions while they stay in the Army. And at the same time they are helping the Army keep 'em rolling.

# USEFUL AUTO HINTS



3" x 7" ICE SCRAPER  
MADE OF THIN,  
HARD FIBER  
BOARD

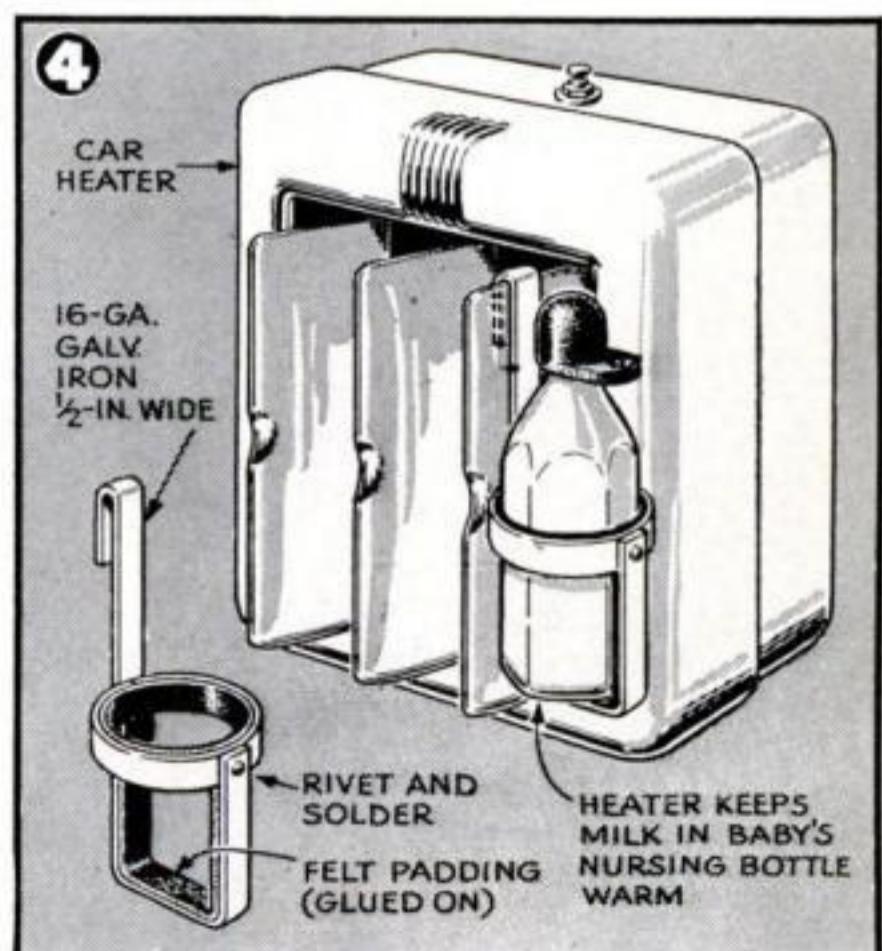
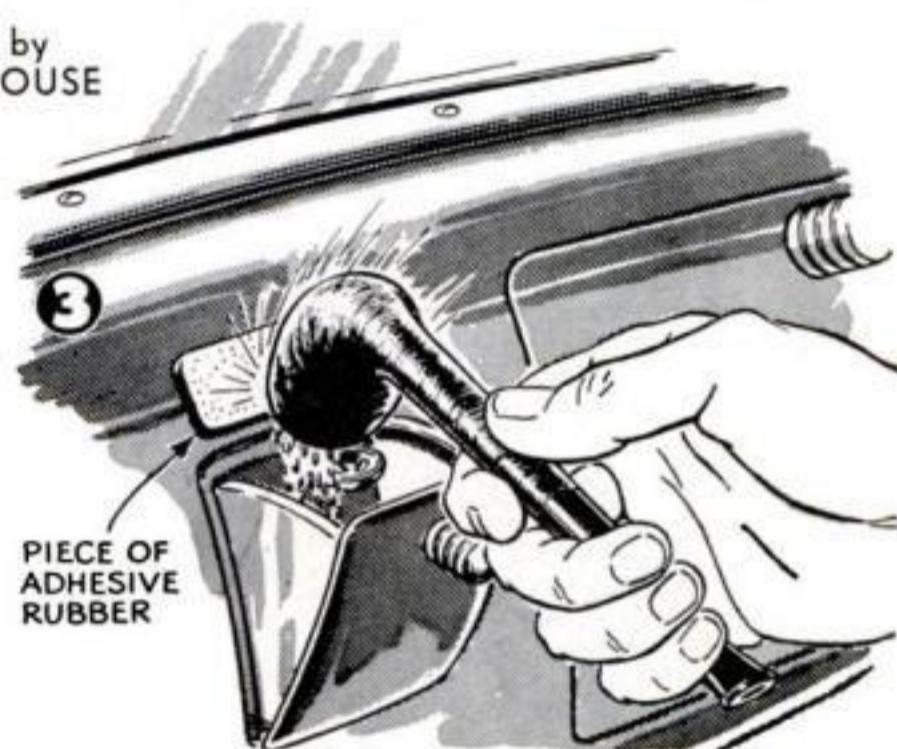
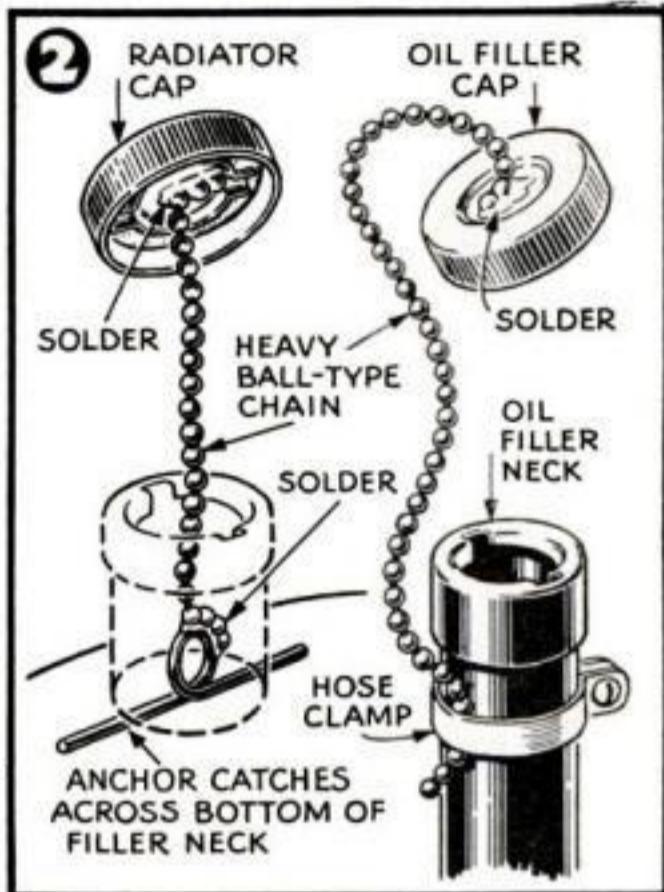
Drawings by  
STEWART ROUSE

**1 AN EFFICIENT SCRAPER** for removing ice and frost, or just plain snow, from the windshields and windows of cars can be made from a piece of stiff fiber board, cut to the size and shape shown. Put a couple of these in your glove compartment when you ready your car for winter. They will come in handy some day.—H. A. T.

**2 TO PREVENT LOSS** of radiator and oil-filler-pipe caps of your car, solder heavy ball-type chains to the caps and connect the other ends with anchors of the types indicated in the drawings. The anchor holding the radiator cap should be made of brass or copper. The oil-filler-cap chain uses an outside clamp.—W.H.Q.

**3 A DASHBOARD PIPE BUMPER** directly over a pull-out-type ash tray can be made by simply affixing a small piece of adhesive-backed rubber to the panel above the tray. Tapping the pipe bowl against the rubber will quickly empty the ashes into the open tray, making it unnecessary to use two hands for the chore.—A.L.G.

**4 TO MAKE A BABY-BOTTLE WARMER** for use on automobile trips, bend two strips of galvanized iron to the shapes shown and rivet them together, adding a drop of solder or two for rigidity. Hung over a door of the car heater, the unit holds a bottle near enough to the blast of warm air to heat it as much as desired.—W.C.F.



# GUS KEEPS 'EM ROLLING

By MARTIN BUNN

"I DUNNO what we're going to do," Joe Clark gloomed to his Model Garage partner, Gus Wilson. "It was tough to lose Harry to the Army. Now he's gone and got himself into that officers' training school, so he'll stay in the service a long time, and when he comes out it isn't likely that he'll be willing to come back to work as a grease monkey. Ever since he left, every half-way-decent mechanic we've managed to get hold of has either enlisted or been blown away by the draft or has quit us to go to work in some defense industry.

"Oh, I ain't kicking—I'm just as patriotic as the next fellow. But how are we going to keep this business running? That's what I'd like to know! Since folks have realized that they're likely to have to make their cars do for a long time we're getting more business than we've ever had before. We need two good mechanics right this minute—we could use three. And what can we get? Nothing but kids fresh out of high school. What the heck are we going to do, Gus?"

Gus looked up from the complicated gadget he had on his workbench—it's an idea that he's working out experimentally before he sends it to the National Inventors' Council down in Washington with what we all think is the well-founded hope that it will be a help in the good work of making Hitler less of a nuisance than he is now. "What are we going to do?" Gus



"Going to hire a girl for the office and I'm coming out in the shop," said Joe. Gus looked downright scared

repeated seriously. "We're going to do the only thing we can do—keep right on trying our darndest to keep our customers' cars rolling. That's our job, Joe, and it's an important job. We'll just have to do the best we can with whatever sort of help we can get. Quit your worrying and hire one of those kids you've been interviewing. It might happen that I could turn him into something useful."

"O.K.," Joe agreed, without enthusiasm. "And I'll tell you something else I'm going to do. I'm going to hire a girl to do most of the work in the office, and I'm coming out here in the shop. Lord knows that I don't pretend to be a mechanic, but there must be some things I could do."

Gus looked downright scared. Joe's few attempts at mechanical work have been far from successful. "That's a swell idea, Joe," he said soothingly, "but for the time being

it would be a lot more sensible for you to keep on running this outfit from the front office. That's *your* job. If the time comes that I need you out there, I'll tell you so. That sounds like Doc Foley's horn."

It was, and a moment later Dr. Foley came in with a worried look on his usually cheerful face. "There's something seriously wrong with my car," he announced. "I think it must be the fuel pump."

"What are the symptoms, Doc?" Gus wanted to know.

"Yesterday afternoon," Dr. Foley told him, "I was doing about forty when I came to that steep hill four or five miles up the road. Half way up it my motor began to labor, and although I stepped on the gas hard it went dead before I got to the top. From the way it died I thought I was out of gas, but the gauge showed that the tank was three quarters full. I took a look under the hood, and so far as I could tell everything was all right—not that I know much about motors. Anyhow, when I got back in the car and stepped on the starter, away she went as nice as you please!"

"I was on my way to see the Dawsons' little girl—she's got the measles. Dawson is a fellow who enjoys fussing with his car, so I told him what had happened. After he had done some checking on my motor, and found that it was running perfectly, he said that probably a speck of dirt had clogged one of the carburetor jets and then worked its way out again, and that I wouldn't have any more trouble.

"I forgot all about it until the same thing happened again today. In fact, it happened three times while I was on my rounds. I know it's after your working hours, but I have a lot of calls to make now that young Dr. Smyth has gone in the Navy and I've taken over his practice, and I just can't

afford to be driving a car that I can't depend on."

"Drive her right in, Doc," Gus invited. "Working hours are whenever I'm here. That goes for the duration!"

By the time Gus had locked his gadget in the office safe Dr. Foley had driven his car into the shop.

Gus looked at its speedometer. "Thirty-six thousand four hundred," he read. "How long have you had this fuel pump, Doc?"

"Why, it's the one that came on the car," Dr. Foley told him. "Anything wrong about that?"

"Maybe not, and maybe there is," Gus said. "Seems to me that it's a good idea to install a new pump every 20,000 miles or so—just to be on the safe side. There's nothing that makes a man feel more helpless than to have his fuel pump go bad when he's ten miles from nowhere in the middle of the night, and leave him with no way of getting gasoline from his tank to his carburetor. But maybe your trouble isn't in the fuel pump at all. I'll have to do a little checking."

He cleaned a small amount of sediment out of the pump bowl. Then he replaced the bowl, opened the gas line from the pump to the carburetor, and stepped on the starter. Gasoline spurted out of the pump. "Your fuel pump is O.K.," he told Dr. Foley, "but I still think that it would be a good idea to put in a new one, considering the mileage. The chances are that the trouble is in the carburetor."

He cleaned out the short line from the pump to the carburetor. Then he took the carburetor apart and blew its jets clean with compressed air. Then he reassembled the carburetor, and again stepped on the starter.

The engine took off promptly and ran smoothly.

"It seems all right now," Gus said. "But it seemed all right a couple of times before, and then went dead on you. Got time for me to take her out for a little road test, Doc?"

"Sure, go ahead," Dr. Foley told him.

Gus was gone for the better part of a half hour. "How was she? All right?" the doctor asked when he drove back into the shop.

"Nope—she's still all wrong," Gus said. "Did the same thing with me that she did with you. The engine drifted to a stop on a hill, but took off fine



Keeping one ear close to the top end of the pipe, Gus listened intently

again when I stepped on the starter. You'll have to let me do some more checking this evening, Doc. Right now I've got to hustle down to the Park House to get my dinner, or the dining room will be closed. I'll drop you off at your house on my way, and I'll bring your car around to you on my way home tonight. If you should get a hurry call before I've got it fixed, phone me and I'll bring my bus around for you to use. O.K.?"

When Gus got back to the Model Garage after he'd eaten a hurried dinner he found the lights burning in the office and Joe Clark busy over his ledgers, and the lights burning in the shop and Ez Zacharias, his postman's cap on the back of his shaggy head, chewing tobacco industriously and gloomily contemplating his mud-plastered R.F.D. sedan. "Joe said you'd be back," Ez explained. "Say, Gus, I'm right behind the eight ball. My ol' bus sounds like all her connecting-rod bearings was burned out. Take a look at the ol' girl, will you?"

"I will if you want to wait until I've found out what's the matter with Doc Foley's car, and fixed it up," Gus told him. "His job's ahead of yours, and I promised it to him for tonight."

"I got lots of time," Ez assented comfortably. "The P.O. Department ain't got us R.F.D. fellers deliverin' mail at night—not yet, anyhow. I'm a-takin' this-here World War Two easy-like—they danged near wore me down over there in France in the first one. 'Course if them Nazis ever came over here I'd feel different. I'd get me a machine gun and show some of these kids who're swaggerin' around in uniforms how we used to—"

He went on sounding off while Gus, paying mighty little attention to him, rechecked the fuel pump and carburetor of Dr. Foley's car. Again he could find nothing wrong with either.

Finally Ez interrupted his monologue. "What's the matter with that crate?" he demanded. Gus described the difficulty.

"Huh!" Ez grunted. "Bet it's the carburetor. Carburetors are the cause of about three quarters of the trouble you have with automobiles. They're like kids' stomachs and hosses' bellies! Hey, look here! When you took the cover off that carburetor I seed that the float bowl was near empty. That ain't natcheral. What's the cause of it, hey?"

Gus stared at him. Then he stared at the float bowl. "You're right, by gum!" he said. "I never thought of that. You are of some use, after all, Ez! Let's see, now."

He examined the float bowl carefully. Then he laughed. "That's one on me," he acknowledged. "See what's wrong, Ez? The float needle is worn to a wedge fit. It sticks so tight when the float bowl is emptied that it doesn't open when the float-arm pressure is removed. Then the engine stops because it isn't getting any gas—and then when you step on the starter the carburetor gets a little jar which loosens the float needle, the gas flows again, and the engine starts. I'll just lap out the valve seat a little with some very fine valve-lapping compound, and Doc won't have any more trouble with it. First time I've ever run into that one. You're some trouble-shooter, Ez!"

Highly pleased with himself, Ez chewed his tobacco placidly and amused himself by scoring an occasional bull's-eye on the waste box while Gus put the valve into workable condition. Then he went into the office and telephoned Dr. Foley. "Your car's O.K. now," he told him. "It wasn't the fuel pump, after all, but it would be good business to put a new one in just the same. How about it?"

"Whatever you say," the doctor told him.

Gus came back into the shop and installed a new fuel pump. Then he turned to Ez. "Now for that wreck of yours," he said. "What did you say is the matter with it this time—a burned out connecting-rod bearing? Let's hear your sad story."

"She's sad, all right," Ez said, grinning. "This morning on my route I had to tramp on the gas pretty hard to make a steep hill, and there was a rap somewhere in the car's innards. Every hill I went up after that the rap got louder. It sounded to me like a connecting-rod bearing gone flooey."

Gus raised the hood. "Start her up, will you?" he said. Ez climbed into his car and started the engine. Gus listened intently for half a minute. "There's a rap, all right," he decided, "but I can't tell where the noise is coming from."

He went over to his workbench and came back with a three-foot length of iron pipe. "Speed her up a little," he told Ez. Keeping one ear close to the upper end of the pipe, he (*Continued on page 218*)

## GUS SAYS:

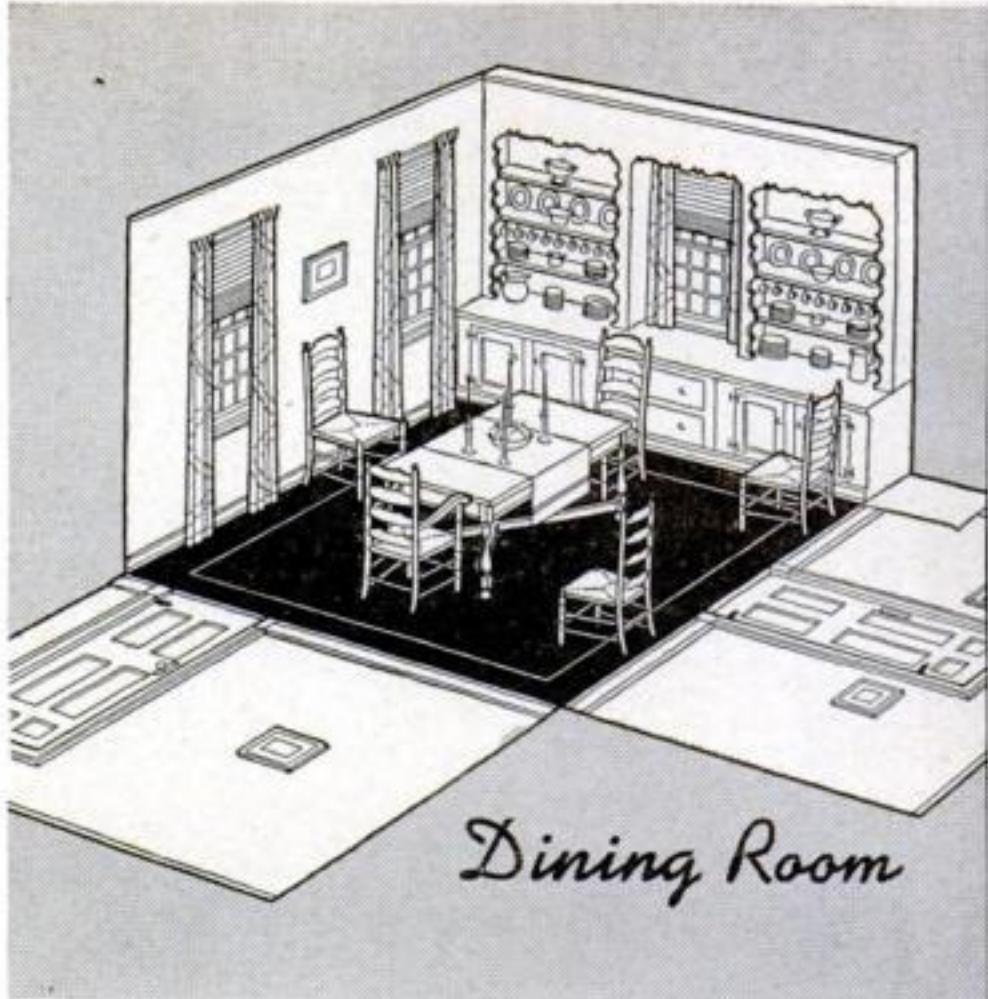
Few seem to realize that most engine trouble shows up first right under your nose—on the dashboard instruments! Glance at them often as you drive and someday you may stop serious trouble before it happens!

# HOME and WORKSHOP



Call it charming, picturesque, or what you please, but a Cape Cod house really looks like home. This design won third prize in our house contest NEXT PAGE

First in popularity among our readers is the lovely, livable Cape Cod style. More houses of this type were submitted in our home-planning contest than any other. The best of these is the house designed by George and Margaret Mallory, of Evanston, Ill., who were awarded third prize in the contest (P.S.M., Oct. '41, p. 138). Their entry was remarkable not alone for the excellence of the design, but also for the completeness of the drawings and description, which filled a large portfolio (see page 154). Following is a considerably condensed version of their specifications, illustrated with plans that have been redrawn to save space, although nothing essential has been omitted.

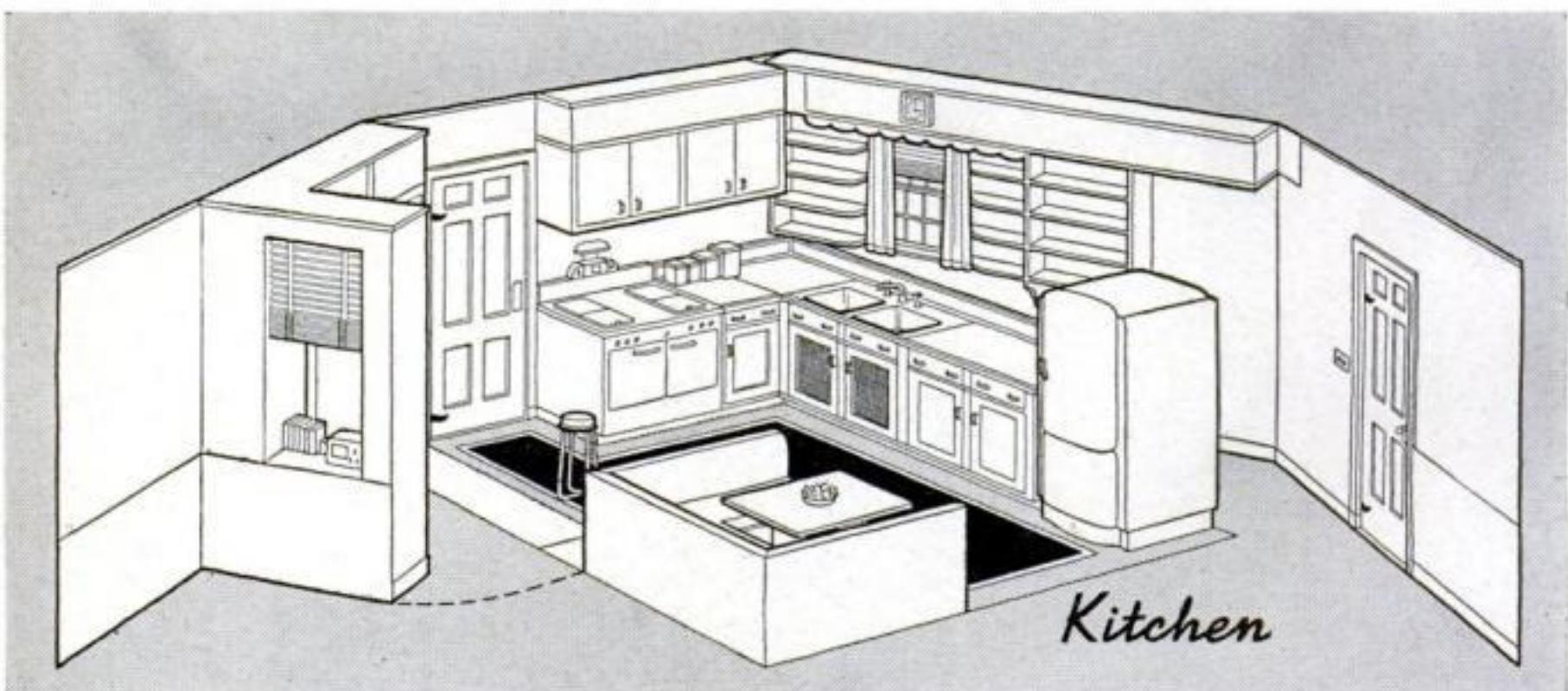


*Dining Room*

A Welsh dresser is built into the east wall, surrounding a window that overlooks the flower garden

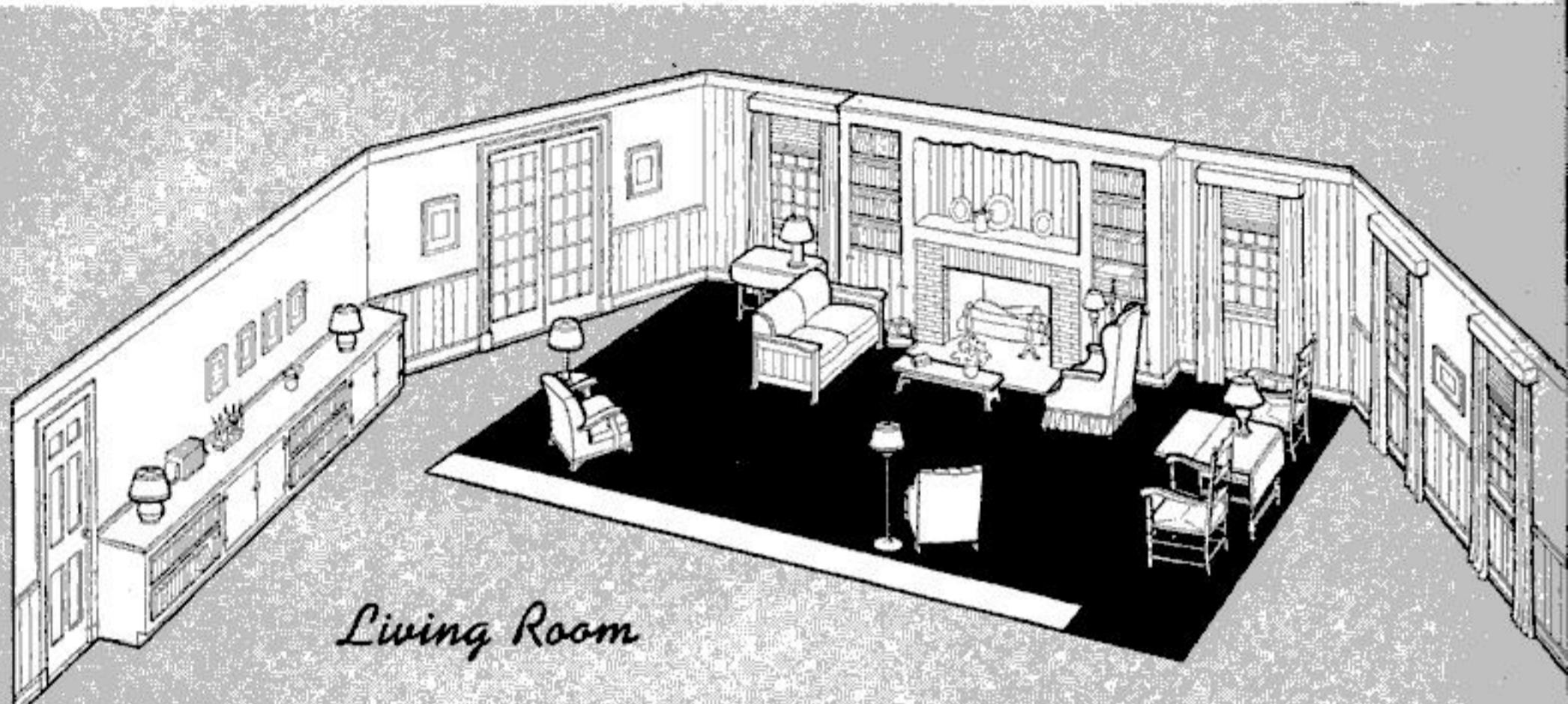
THESE are the working plans for our intended home, which we have spent two years designing. Now, we believe, it perfectly suits the needs and demands of our family.

It is Cape Cod in style, with modifications that do not detract from the type, but add to convenience. The front elevation is typically low—one story with an uninterrupted roof line; the rear, however, is a full two stories to increase the cubage of the second floor, enabling us to have three rooms as against the traditional single room or possibly two. This also allows for an extra



*Kitchen*

This kitchen is a housewife's paradise. Note that a partition separates the breakfast nook from the rest of the room; it is fitted with a Venetian blind for privacy, and there is space for radio and books



*Living Room*

For clearness, the living room and several other rooms are shown as if the walls had been opened up so that all four can be seen at once. See the floor plans for the exact shape, orientation, and dimensions

# Cape Cod House Wins Third Prize

## IN OUR HOME-PLANNING CONTEST

room on the first floor, necessary for our growing family.

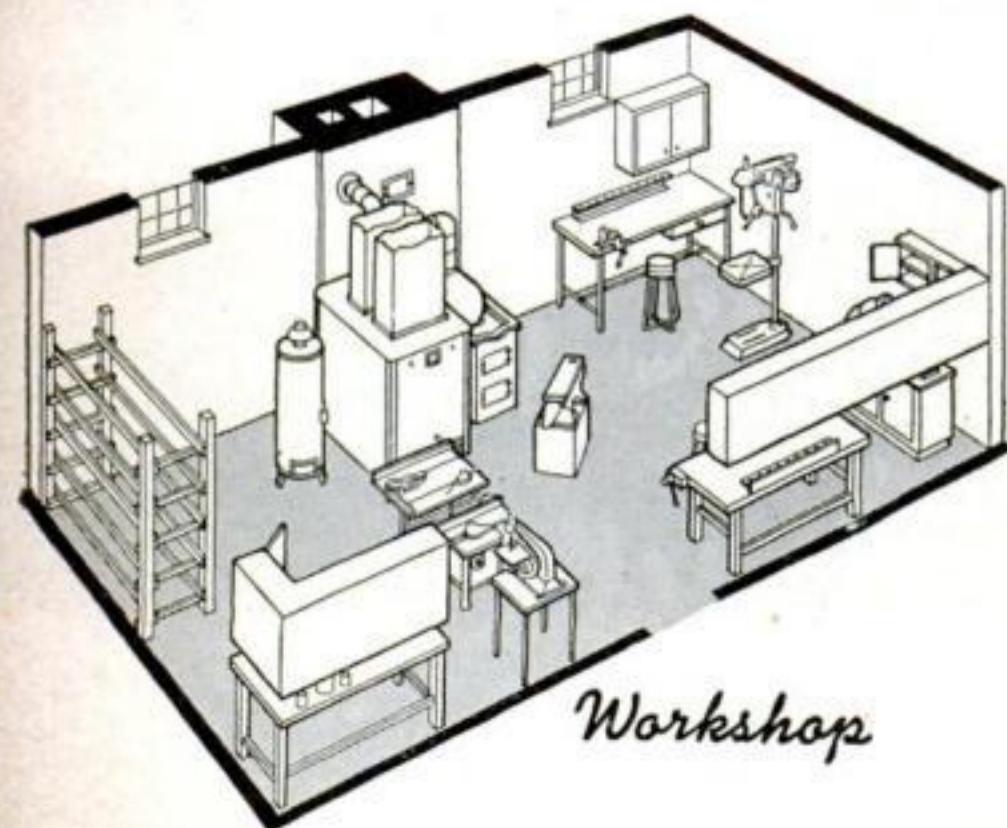
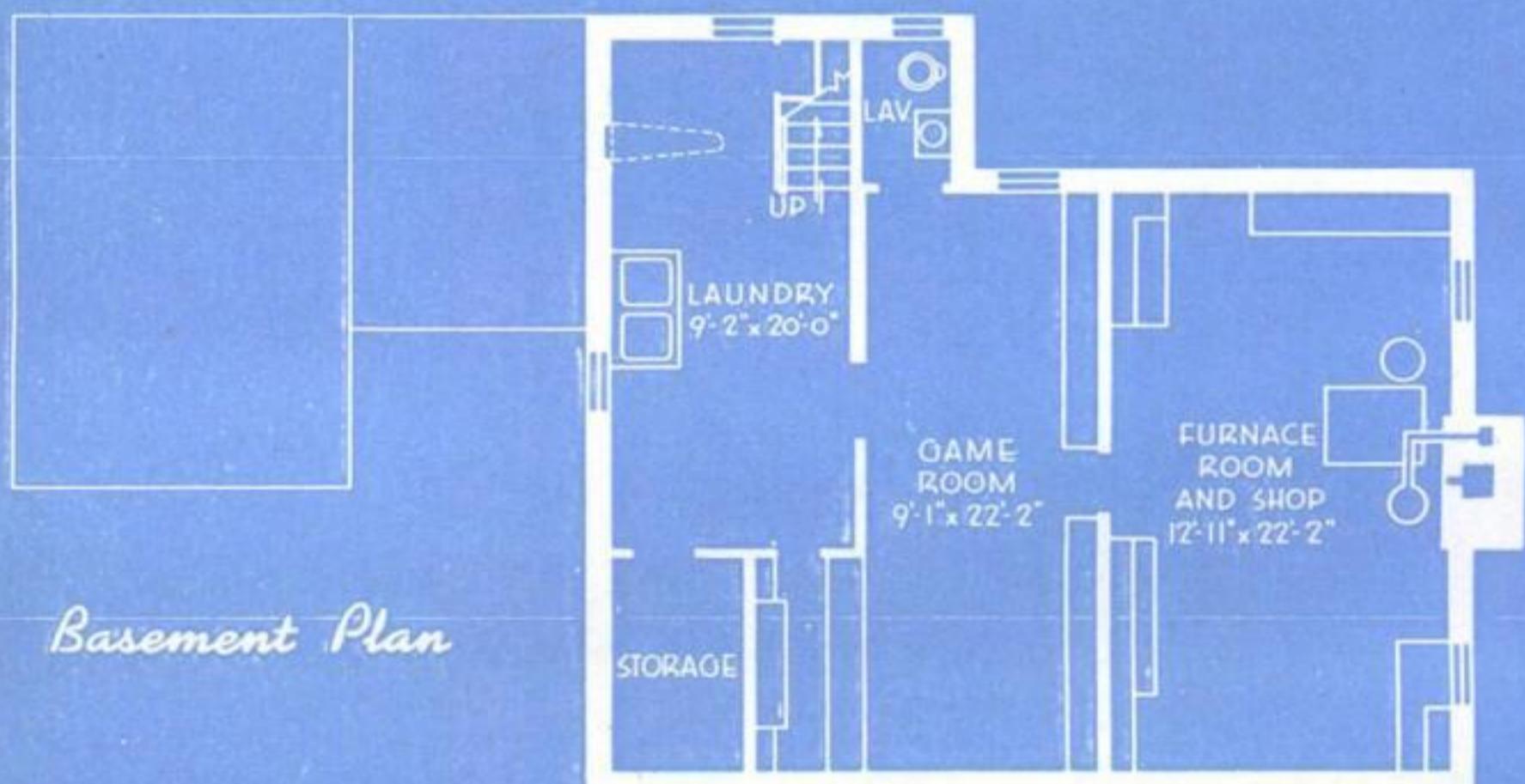
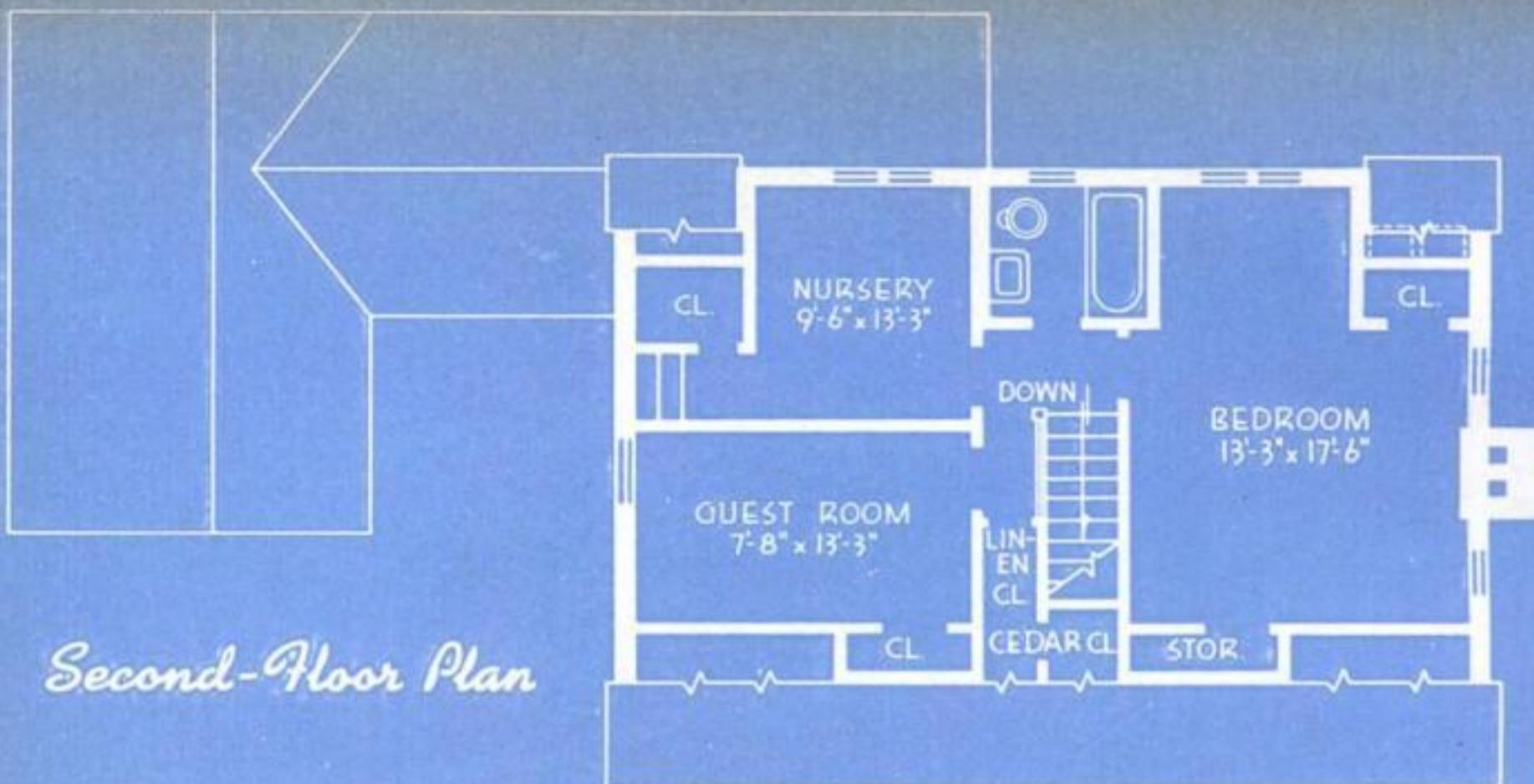
A further modification is a flagstone terrace at the rear of the living room to make a more attractive vista and entrance to the garden. A screened porch between the house and garage adds to the enjoyment of the garden and, together with the garage, enables us to place the small flower garden, so usual between the picket fence and the house, at the side of our house. Thus we preserve the appearance of fence and garden, yet retain the full expanse of front lawn.

Inside we adhere to Cape Cod features except where modifications increase convenience. The kitchen and bathroom appointments are admittedly modern. The lighting fixtures are not strictly in keeping, and the doors, except for one, are paneled

rather than batten-backed. The maple furniture retains the period influence, but is light, not heavy or rough, and allows for more freedom in decoration.

Our choice of style is economical in several ways. The house is compact, which makes heating inexpensive. The wall lengths inside as well as out are straight, not cut up, and this lessens the construction costs.

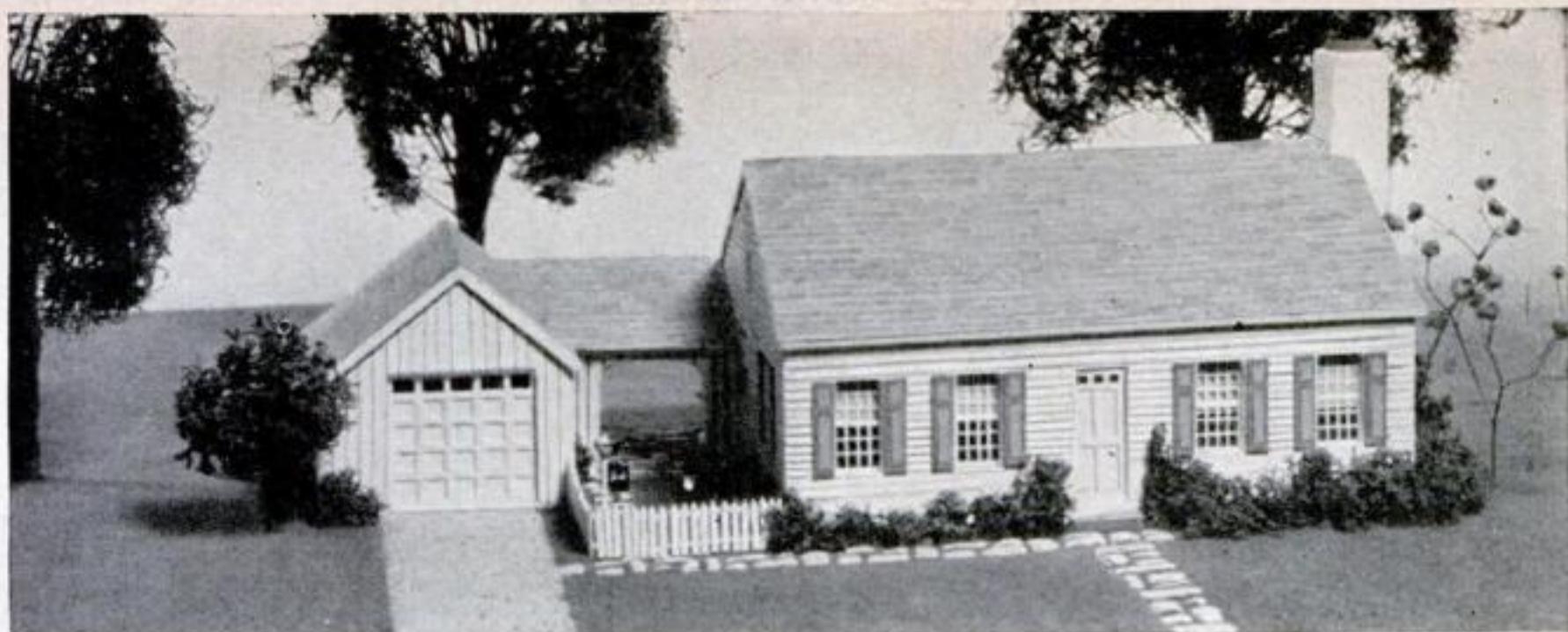
The house itself, without the extensions at side and rear, has a 34' frontage and is 24' deep. With porch and garage added, it can be built on a 75' lot with 5' to spare, or, preferably, on an 80' lot with 10' to spare. If the porch and garage were placed back of the house, a 50' lot would be wide enough. The depth should be 150' or 160'. With the addition of 5' on the east side of the garage, it would be possible to have a two-car ga-



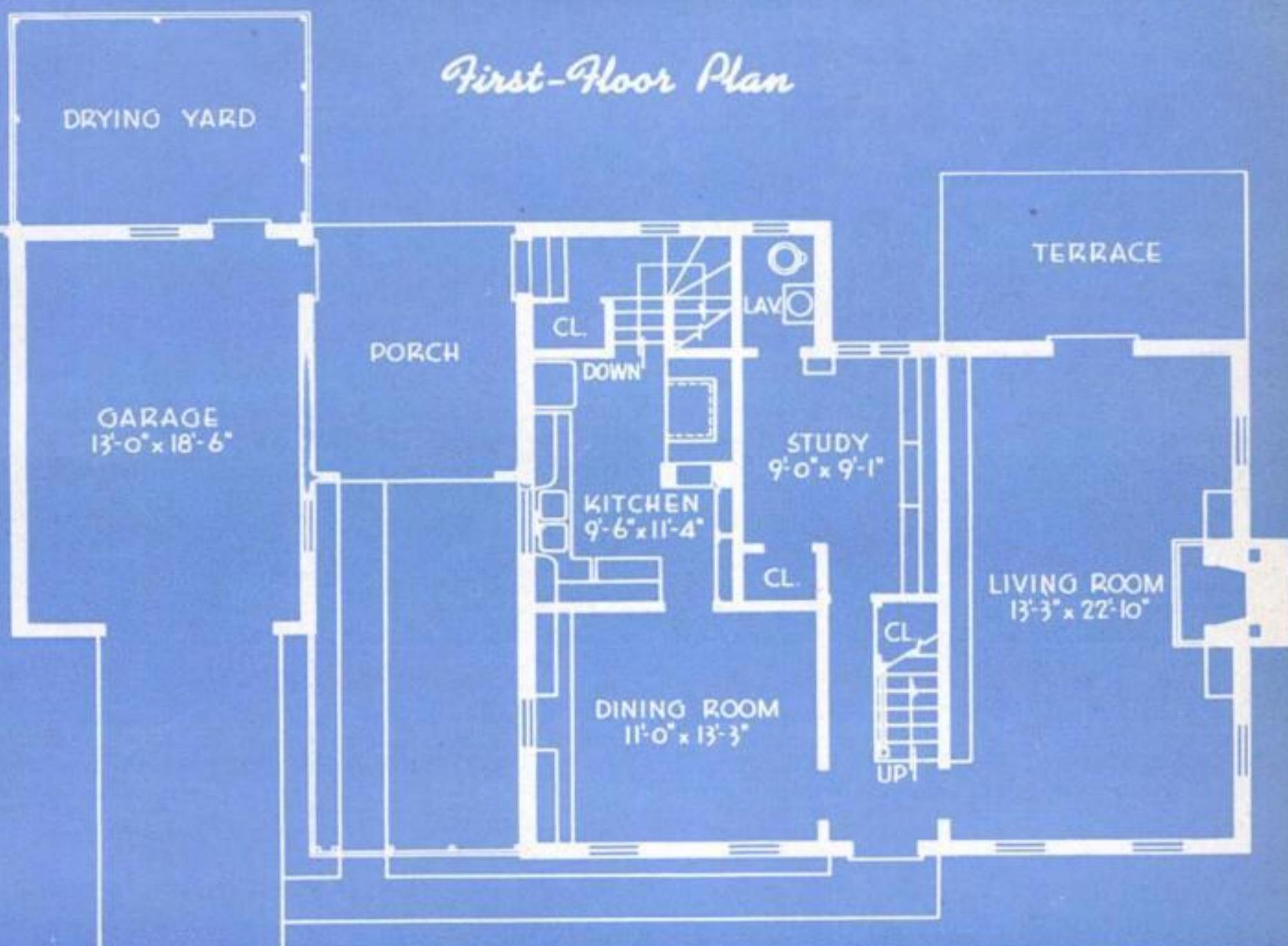
rage, since the present plan calls for 4' more space than necessary, which we intend to use for storing tools.

We wish to have the house face north since the only rooms having windows on that side also have another exposure. This permits eastern sun in the kitchen and dining room, and southern light in the nursery and study, which have windows in only one wall.

*Costs, size of family, and income.* The house will contain 20,278 cu. ft., and the garage 1,804 cu. ft. At 35 cents per cubic foot, the cost of the house will be \$7,097 and



*First-Floor Plan*



All drawings by Sigman-Ward; model by Louis Fromm, architectural model maker

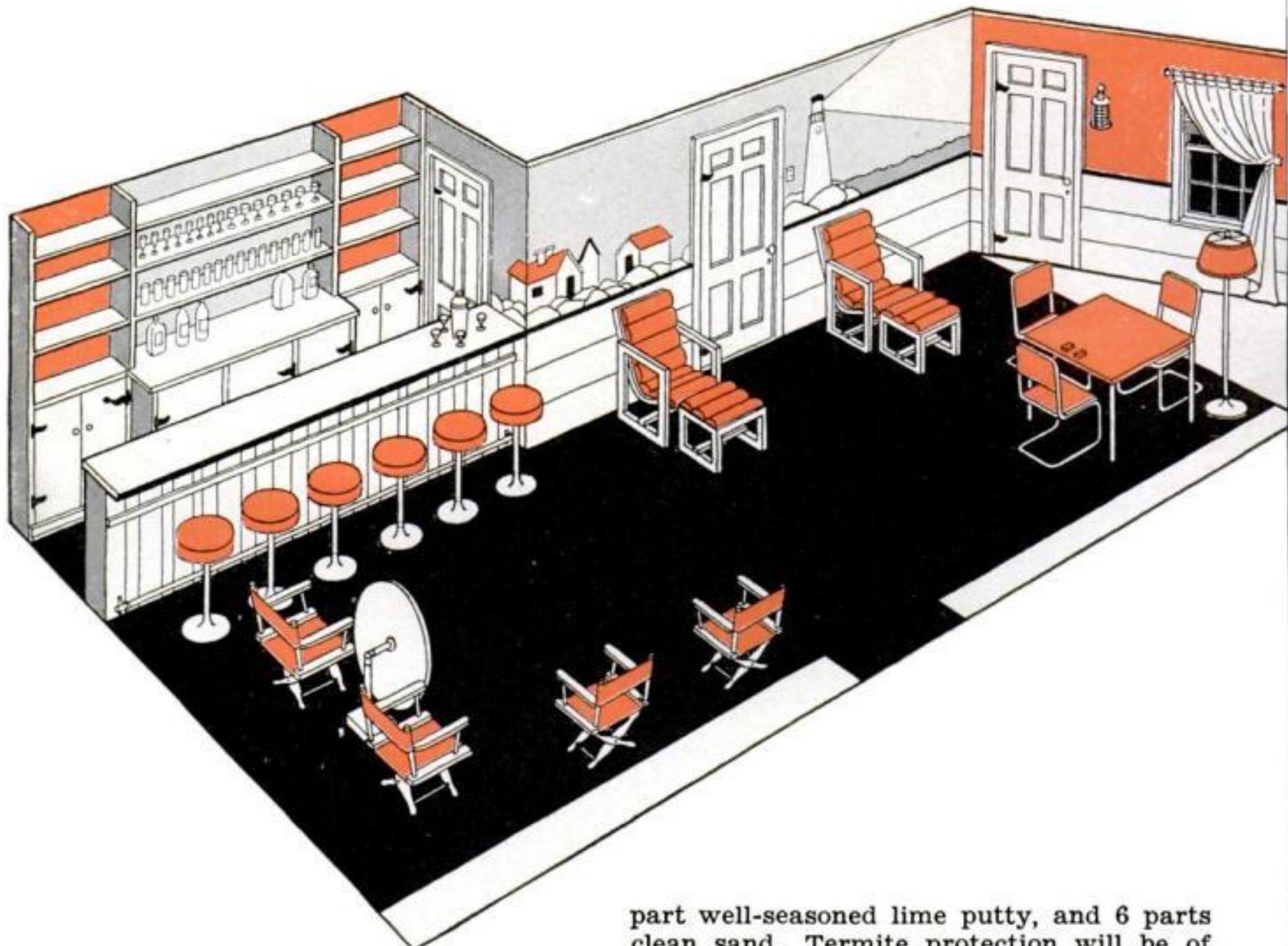
of the garage \$630, a total of \$7,727. There will be an allowance of \$900 for those extras not included in the contract, bringing the cost to \$8,627. An architect will be employed. If his fee is 8 percent, the savings effected in lessening that amount for extras will probably bring the added cost down to 4 percent, or \$345.

The largest lot we could need would have a frontage of 80'. In many suburbs now being developed in our vicinity, land can be bought for \$50 per front foot or less, which would bring the cost of our lot to \$4,000 at the outside. For the 50' lot we could com-

promise on, the cost would be only \$2,500.

The family, at present, consists of husband, wife, and daughter, under two. The Mallory income is \$250 a month, or \$3,000 a year. Therefore, the house, exclusive of lot, will cost two and two-thirds times the yearly salary.

*Excavation and foundation.* The basement excavation will be deep enough for the house to appear to lie close to the ground as a Cape Cod cottage should. The height of the finished basement will be  $7\frac{1}{2}'$ , and the two floors above,  $8\frac{1}{2}'$ . Heating ducts, cutting into headroom, will be avoided



where possible; where not, they will be rectangular.

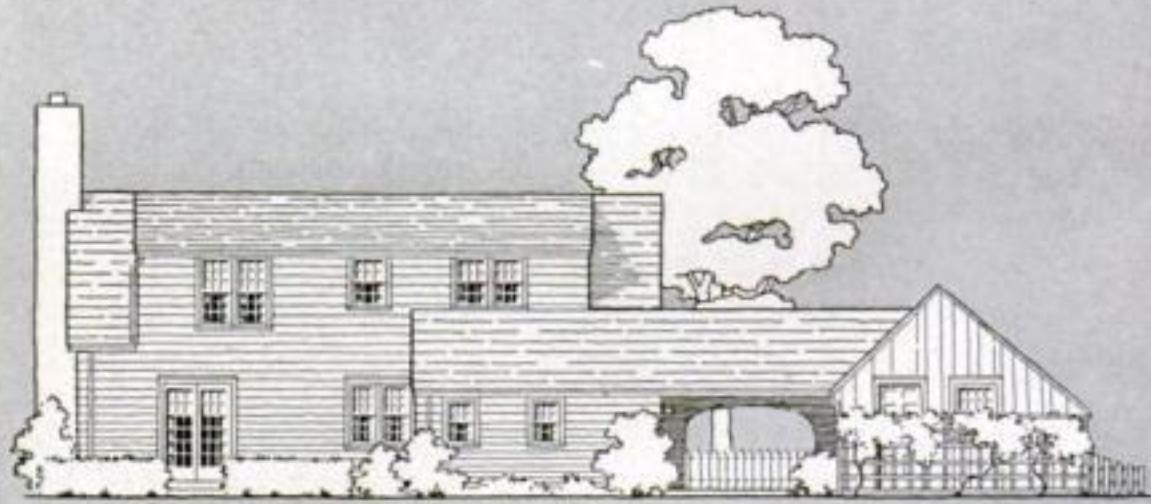
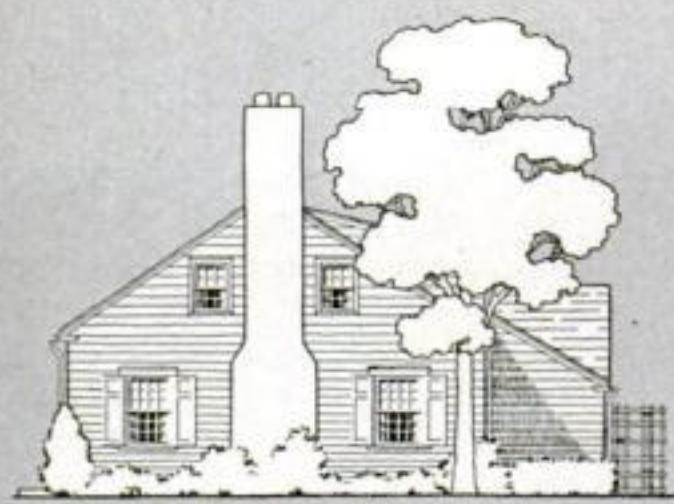
The footing will be on solid earth with the base square, 15" wide and 12" thick. We will use 2,000-lb. concrete, 6 bags of Portland cement to the cubic yard, and 6½ gal. water to the sack of cement, including water contained in the aggregate.

The foundation walls will be 10" concrete with a toggle to receive a hard-burned shale-brick water table. The table is to be laid in mortar of 1 part Portland cement, 1

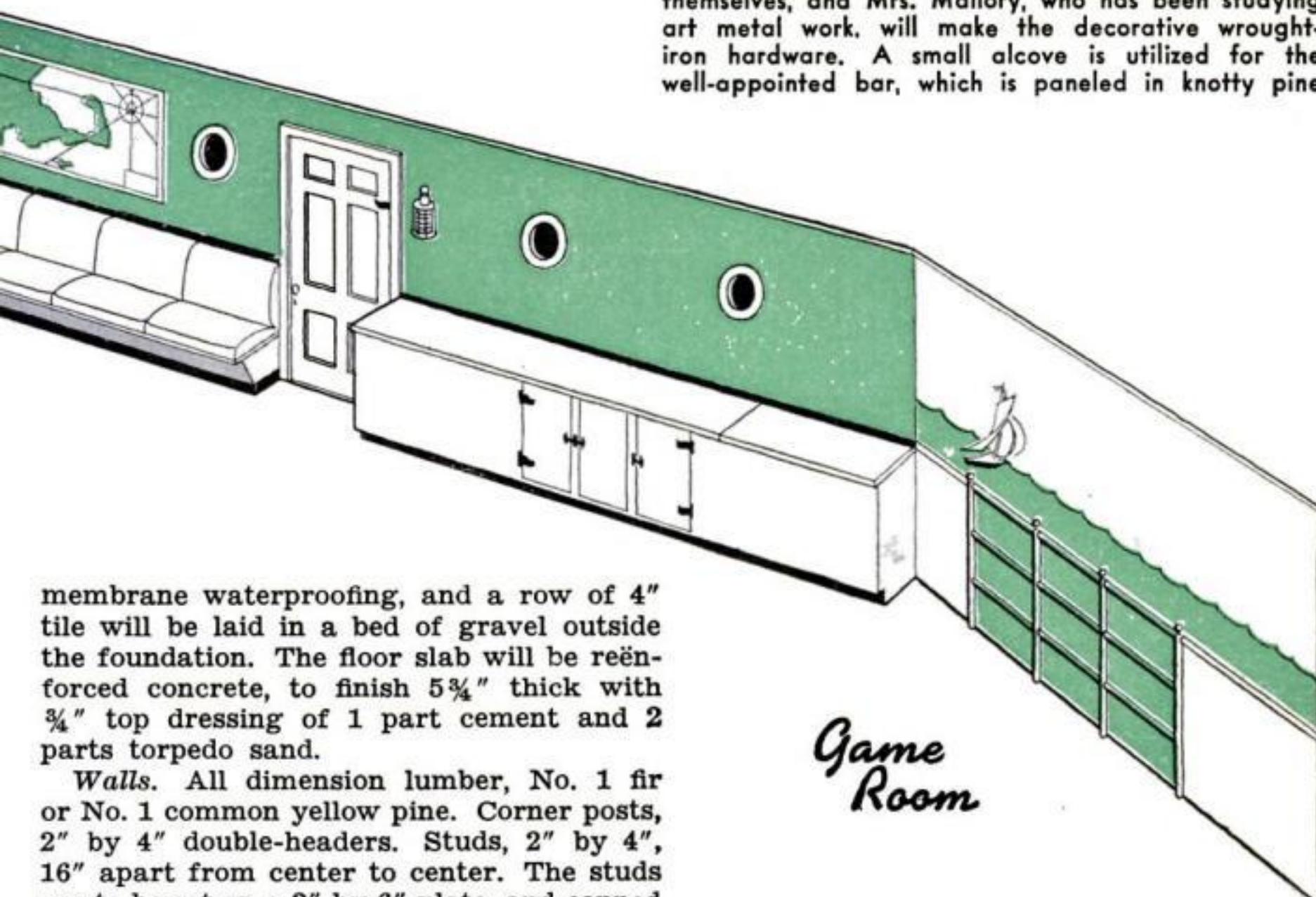
part well-seasoned lime putty, and 6 parts clean sand. Termite protection will be of copper sheet placed at the top of the foundation wall.

The frame house will be anchored to the foundation with bolts embedded in the concrete wall. The sill, too, will be bolted to the foundation and laid in cement. The joists will be No. 1 yellow pine or No. 1 fir, supported by interior partitions, doubled around all openings.

The foundation wall will extend above the ground. The basement windows will have concrete areaways, with a vertical drainpipe reaching to the foundation tile. The wall will be waterproofed with asphalt



When it came to the game room, the Mallorys really let themselves go. They plan to paint the murals themselves, and Mrs. Mallory, who has been studying art metal work, will make the decorative wrought-iron hardware. A small alcove is utilized for the well-appointed bar, which is paneled in knotty pine



membrane waterproofing, and a row of 4" tile will be laid in a bed of gravel outside the foundation. The floor slab will be reënforced concrete, to finish  $5\frac{3}{4}$ " thick with  $\frac{3}{4}$ " top dressing of 1 part cement and 2 parts torpedo sand.

**Walls.** All dimension lumber, No. 1 fir or No. 1 common yellow pine. Corner posts, 2" by 4" double-headers. Studs, 2" by 4", 16" apart from center to center. The studs are to be set on a 2" by 6" plate, and capped with a double plate of the same dimensions.

The sheathing will be 6" boarding nailed on diagonally. It will be covered with a layer of kraft building paper. The cypress siding will overlap to be waterproof.

Balsam wool batts, sealed in waterproof paper bags, will be placed in the outer walls and roof. Over this will be gypsum lath (fire resistant). There will be metal corner beads at all the exposed plaster corners.

Plaster will be a coat of brown plaster consisting of 1 part gypsum to 3 parts sand laid to screeds (guides); the finish coat, 1 part aged lime putty and 1 part plaster of Paris, except in kitchen and baths, where 1

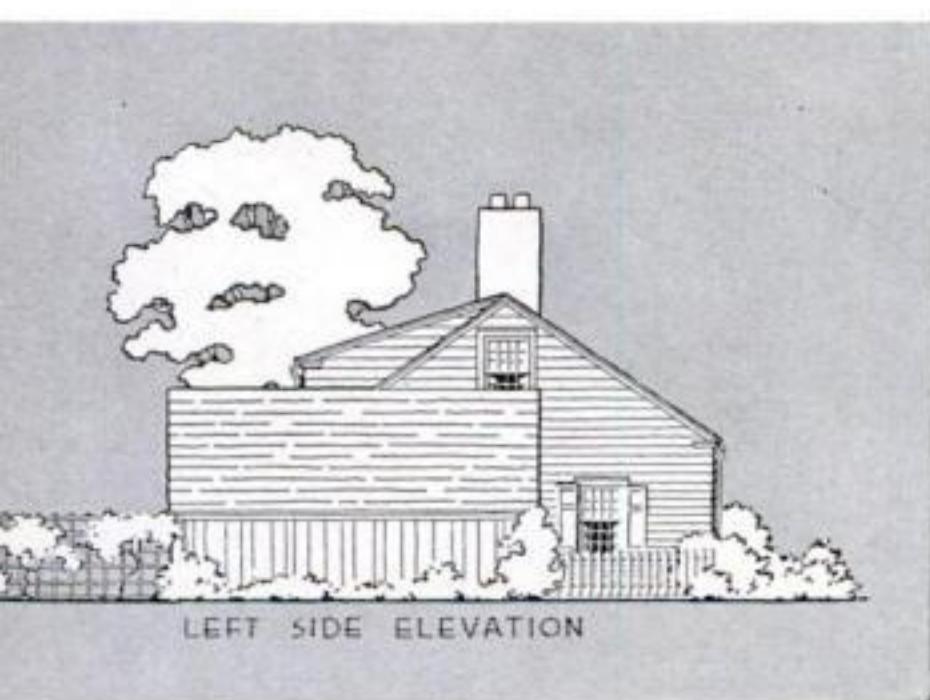
part aged lime putty and 1 part Keene's cement will be used.

**Roof.** Rafters are to be 2" by 8" No. 1 fir or yellow pine. Collar beams above the mid-point of the rafters will keep the roof from spreading. Sheathing will be laid horizontally, tight, and double-nailed at every rafter. Over this one layer of waterproof paper will be nailed. Shingles will be asbestos—a weathered shade resembling wood.

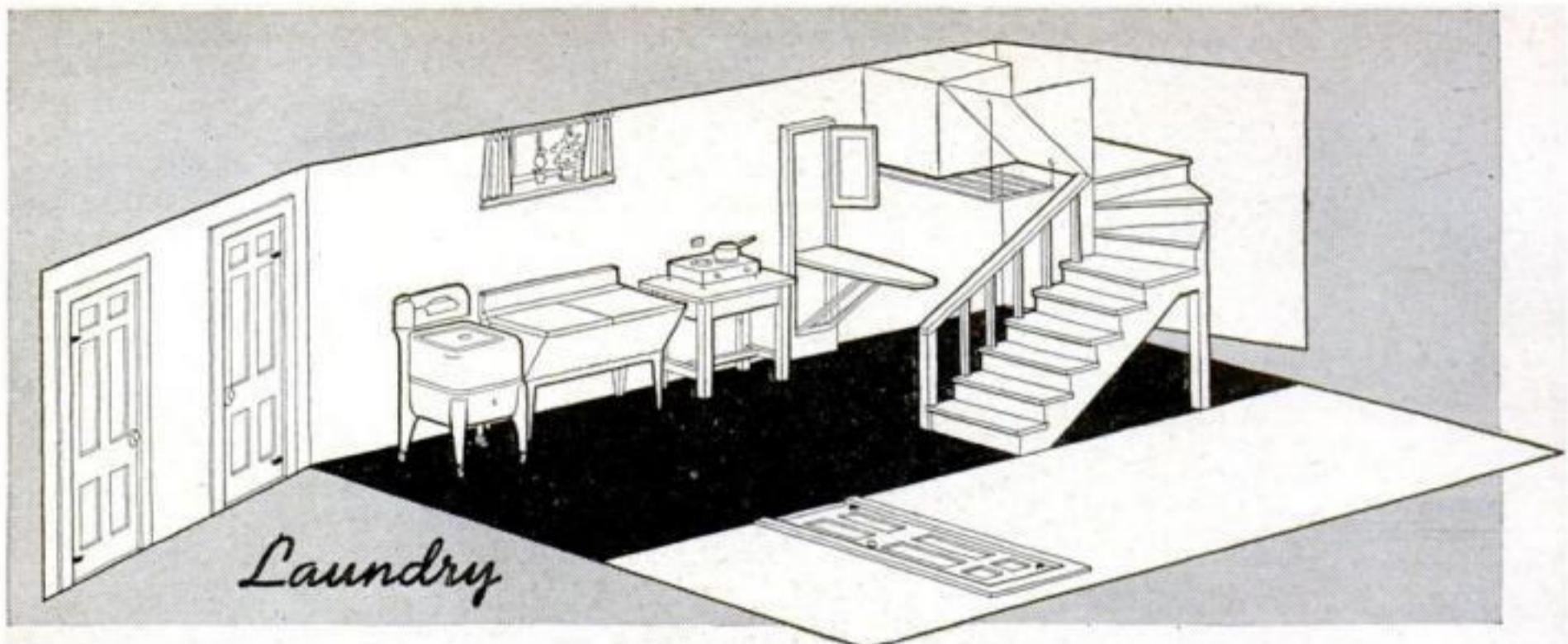
Flashings will be of 16-oz. copper. Gutters, of 16-oz. copper, will be 5" half-round with a rolled edge, secured every 4' with copper hangers. The conductor pipes will be square, of 16-oz. hard copper.

**Floors.** Joists, 2" by 10", are to be spaced 16" apart on centers. They will overlap on all bearing partitions and be spiked to them and to each other. The subflooring will be laid diagonally. On top will be two thicknesses of 30-lb. wool felt for sound deadening. The finish floor will be of random-width Ponderosa pine, grade B and better,  $13/16$ " thick. In the bathrooms and kitchen, the floors will be  $2\frac{1}{4}$ " by  $25/32$ " second-quality maple, covered with linoleum.

**Windows and doors.** Wooden window and door frames will be stock sizes for economy, back primed upon arrival to preserve them and prevent warping. The grounds, or



LEFT SIDE ELEVATION



On this and the facing pages are opened-up views of the laundry, study, nursery, and downstairs hall. Laundry equipment includes tubs, drying lines, ironing board, washing machine, and small electric stove

nailing strips, are to be fastened to the walls flush with the finished plaster. The windows will be authentic Cape Cod, twenty-four and twelve light, double-hung. Zinc weatherstripping will be installed at all windows and exterior doors.

Porch, door, and window screens will be 16-mesh copper wire set in frames of  $1\frac{1}{8}$ " white pine. Glass storm doors and windows are provided throughout. Overhead-type garage doors will have square panels with windows in the top row. French doors will be used at the south end of the living room. Room doors will be six-paneled.

*Trim.* The trim throughout will be of birch. The walls in the living room and game room are to be paneled horizontally 3' up. The west wall of the living room is paneled in random-width knotty pine vertically from floor to ceiling, as is the alcove of the game room. The west wall of the front hall and the stair well are finished in the same manner. There are four false boxed-in beams of birch in the ceiling of the living room. Base moldings are 6" wide in every room except baths and kitchen. In the bathrooms, wall board resembling tile reaches 3' from the floor, and in the bath alcove to the ceiling.

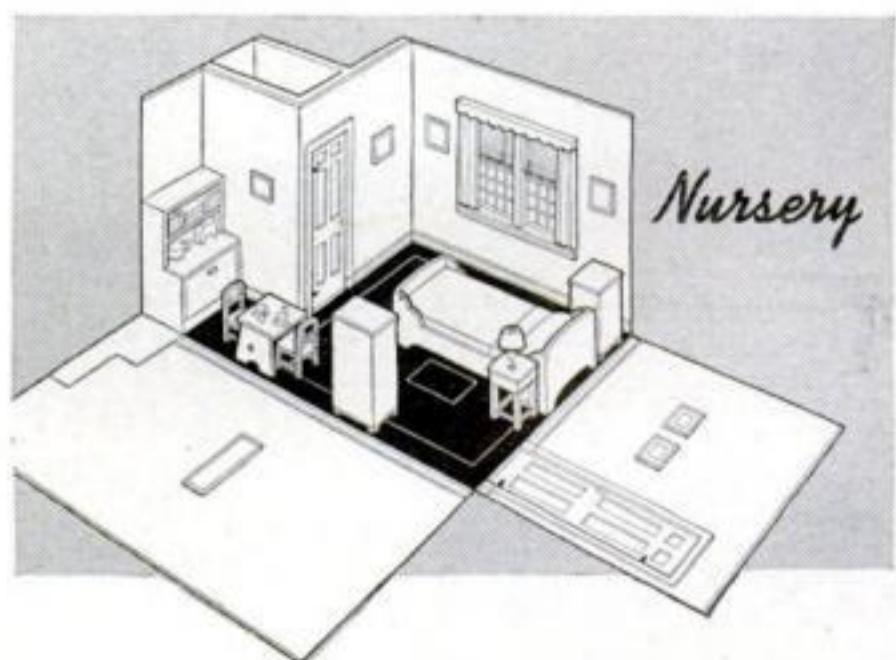
*Stairs.* The stairways have ceiling-height headroom all the way up. The pitch, to avoid steepness, calls for 11" treads (including the nosings) and  $7\frac{1}{2}$ " risers. The finish on the front stairs will be white painted risers and mahogany-finished birch treads. The basement stairs will be painted and have a rubber mat nailed on each tread. The front step is of mortared flagstone.

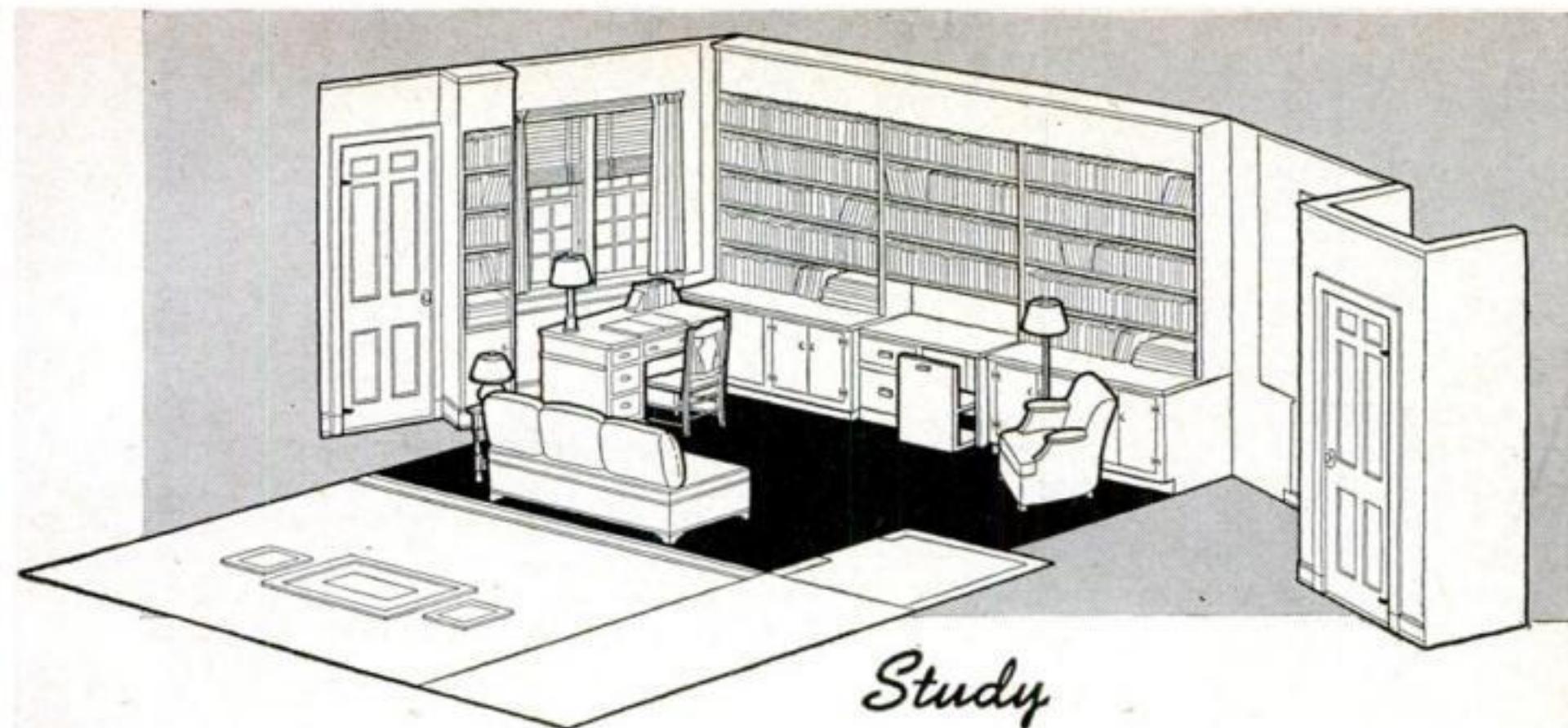
*Chimney.* The brick chimney will have head and cross joints filled full and smooth and be lined with fire-resistant clay flue linings. It reaches 5' above the roof, and the flue linings are to extend at least 6"

above the top. Built into the fireplace area will be a cast-iron damper and an ash dump; at the bottom of the flue there will be cast-iron clean-out doors for furnace and fireplace. The base of the hearth will be concrete on a brick arch, with a layer of split fire brick laid flush with the floor.

*Heating and gas.* The heat will be direct warm air, thermostat-controlled; the fuel preferably gas or oil. The furnace will include a forced-air (blower-filter) unit to make smaller ducts and air-conditioning possible. Grille registers will be set in the walls at the baseboard—two vents in the living room, and one each in the others. Gas equipment will include a range, water heater, and Bunsen burner in the basement shop. The water heater will have automatic control, cork-jacket insulation, and 60-gal. tank.

*Plumbing.* Joints in soil pipe and liquid-bearing pipe will be caulked and soldered. Soil pipes will be wrapped in hair felt to deaden bathroom sounds, and asbestos air-cell insulation will be used to prevent pipes from freezing on outside walls. The piping will be copper for water supply and cast iron for waste and vents.





## Study

**Wiring.** To be adequate for varying loads in each circuit, arranged for a maximum of 1,000 watts in each, with an individual circuit for the refrigerator. A cut-out cabinet in the kitchen containing a series of switches will eliminate fuses. Outlets will be spaced not further than 12' apart.

**Kitchen.** The sink will be of steel with baked-on enamel finish, equipped with a right-hand drain board, mixing spout, rinsing spray, and removable cup strainer. There are two full-size closets in the kitchen and another one halfway down the back stairs.

**Laundry.** The laundry equipment includes a two-compartment tub, drying lines, ironing board, washing machine, and electric plate for starch and boiling.

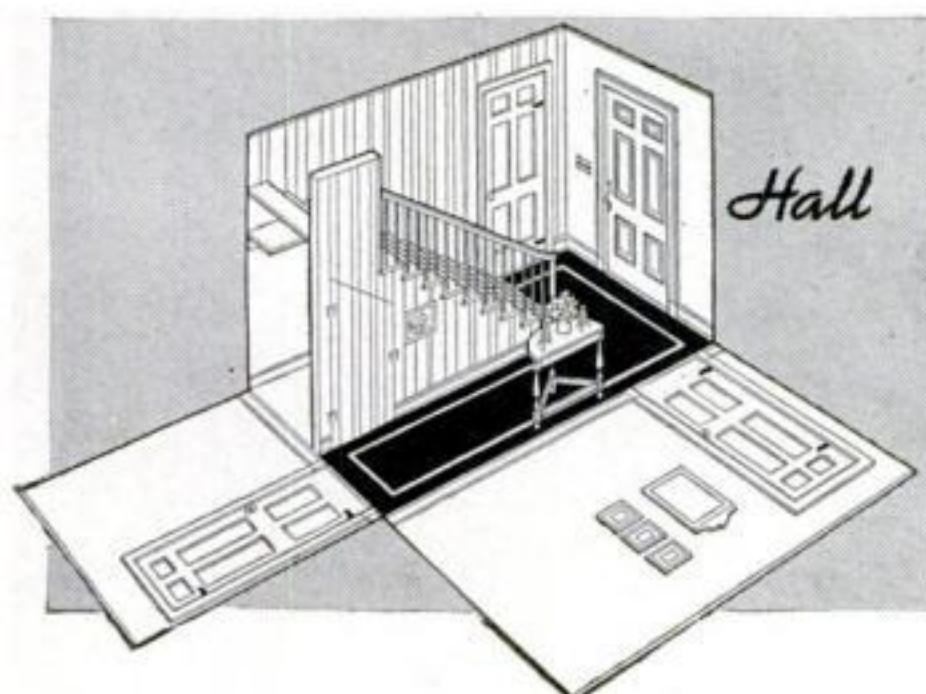
**Shop.** The shop and heater room is large enough for a good-sized workshop where we expect to spend much time. Our hobbies include furniture making, metal work, and model making. We already have some of the power tools—a metal-working lathe, drill press, circular saw, jig saw, forge and blower, and anvil. We have divided the shop into sections: for metal work, woodwork, and painting. The metal-work sec-

tion will have the forge and blower connected to the chimney flue above the furnace, and the anvil nearby. The drill press and lathe are conveniently near for both metal and woodwork. There are metal and wood-working benches, each with its wall cabinets for tools; paint bench and cupboards for keeping paints, cleaners, and brushes; and lumber rack and storage bin for new lumber, scraps, and partially completed projects.

We are using POPULAR SCIENCE'S idea in placing the jointer on the same stand with the saw. The stand, however, will be on casters that may be lowered by means of a lever to facilitate moving the saw about the shop. The jig saw is nearby. Outlets and lights will be placed near each power unit and bench. A master switch will cut out all power tools, and will be out of reach of children in a locked wall box.

**Hardware.** The exterior and garage doors will have accessories of bronze. The identification sign and lamp, as well as hinges and latches on fence and trellis, will be barffed (rustproofed) hand-wrought iron. Interior-door and fireplace accessories will be wrought iron. Light switches will be mirror backed, and the side lights in the dining room will be mirrored. The kitchen and game-room hardware will be chromium, as will the bathroom fixtures.

**Finishes.** With the exception of the shutters, all the exterior painting will be white—one coat of white lead and two of white lead and oil-pigment paint. The shutters will have three coats of oil-pigment paint, preferably navy blue. The interior birch will be treated with white lead, wiped off, and finished with a coat of wax. The walls, three weeks after plastering is hand dry, will receive one coat of good glue size and one of pastel calcimine.



# Third-Prize Winners

SUBMITTED 20 DRAWINGS, WROTE 6,000 WORDS

**G**EORGE AND MARGARET MALLORY, of Evanston, Ill., were the only husband-and-wife team to win a top prize in the \$1,000 POPULAR SCIENCE home-planning contest. Even before they were married, three years ago, this young couple began planning details of the house they hoped to own. By the time the competition was announced, their prize-winning design was already pretty well planned on paper.

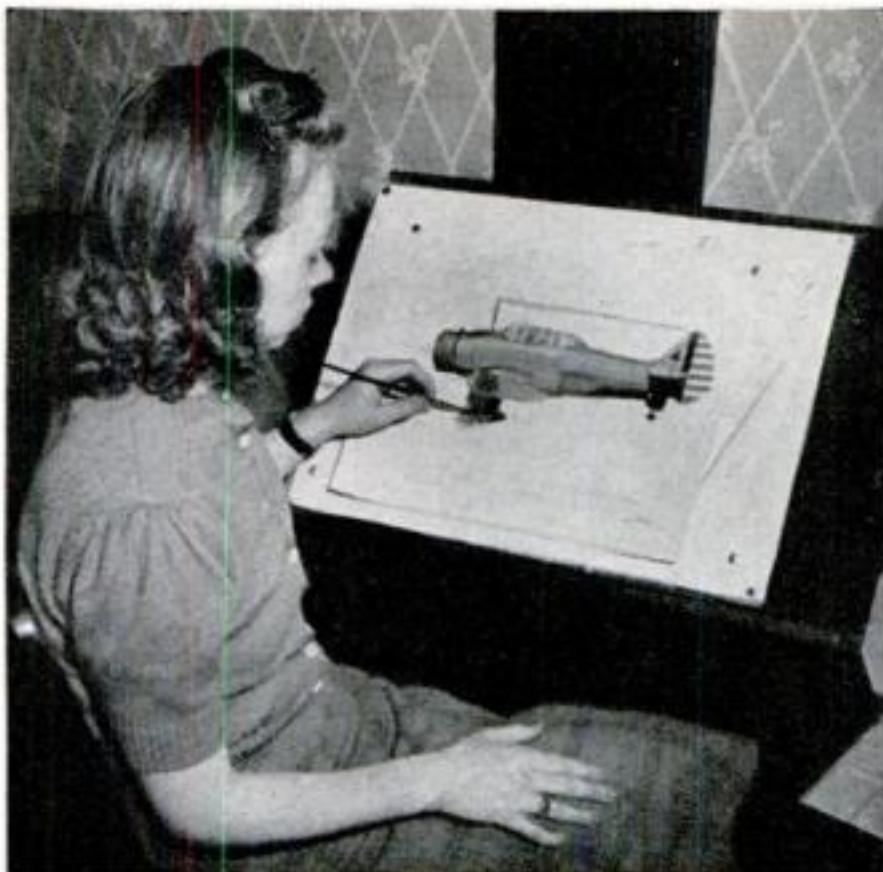
In the collaboration, Mallory did the floor

plans and his wife worked out the room designs and the final drawings. Their entry, of extraordinary completeness, consisted of 20 drawings, 11 of them in color, and a detailed typewritten description of about 6,000 words.

Art and mechanical-drawing courses, taken in high school, helped them in working up the plans. Last winter Mrs. Mallory attended a night course in metal work so as to prepare herself for making decorative hardware for the house they plan to build.



Mr. and Mrs. Mallory with their 18-months-old daughter Margaret. The Mallory entry was the joint work of husband and wife. He concentrated on the floor plans; she prepared the interior designs



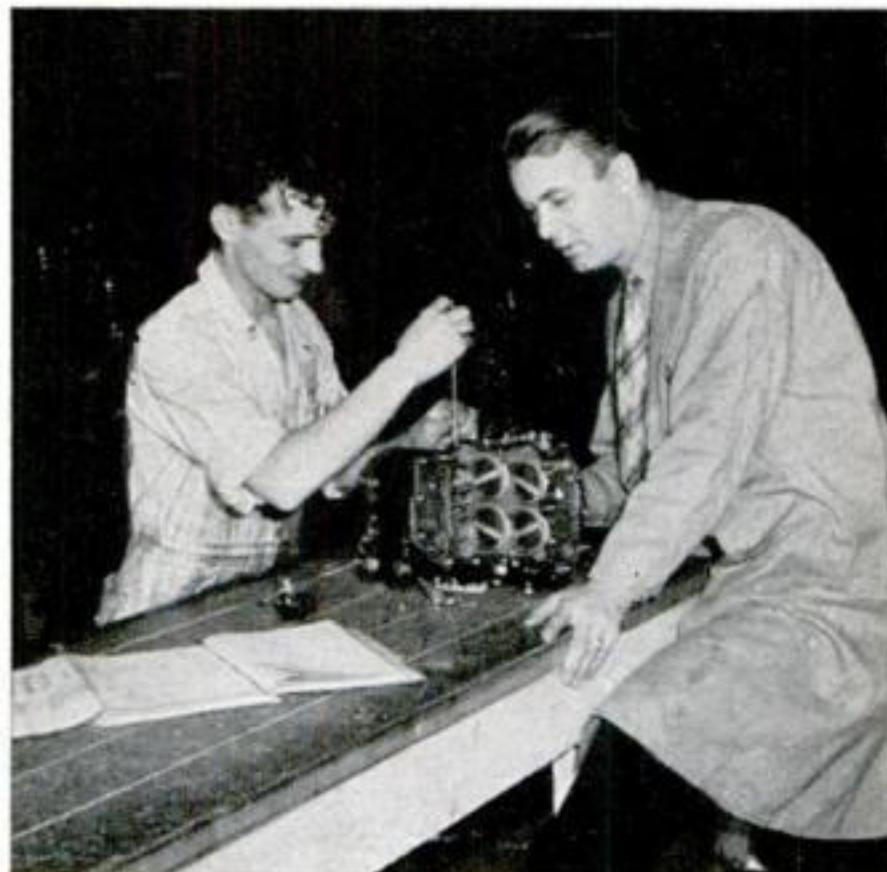
**Painting airplanes is the hobby of Mrs. Mallory. Always fond of drawing, she studied interior decoration at Evanston High School and Smith College**

**Even before her marriage, Mrs. Mallory had her heart set on a Cape Cod house. She and her husband will build in Amherst, Mass., his home town**



From the beginning the Mallorys were certain they wanted a Cape Cod style house. The downstairs, featuring a large living room and fireplace, presented little difficulty. The upstairs, however, had to be designed over and over again before they were satisfied. The final changes in the house were placing a study at the back and adding a workshop to the furnace room. Mallory's hobby is making model airplanes; Mrs. Mallory's is painting water colors of aircraft in flight.

Last June, Mallory was graduated from a Chicago aeronautical school as a licensed plane and motor mechanic. During the time



**During the period of the contest, Mallory (left) was studying in a Chicago aeronautical school. He is now a mechanic at Wright Field, Dayton, Ohio**

**Mallory's enthusiasm for aviation extends even to models. To pay for his aeronautical course, he worked in an express office from 6 p.m. to 2 a.m.**



he was helping finish up the house plans, he attended the school during the day and worked from 6 p.m. to 2 a.m. in an express office. Week-ends he devoted to the plans. His wife worked up the final drawings in the evenings after their 18-months-old daughter was in bed. All told, the Mallorys spent the evenings and week-ends of more than two months polishing the details of their design. They have a building lot picked out in Amherst, Mass., his boyhood home, where they hope the house will someday arise. And the POPULAR SCIENCE prize money has already been tucked away in a bank account marked "Building Fund."



FIG. 2

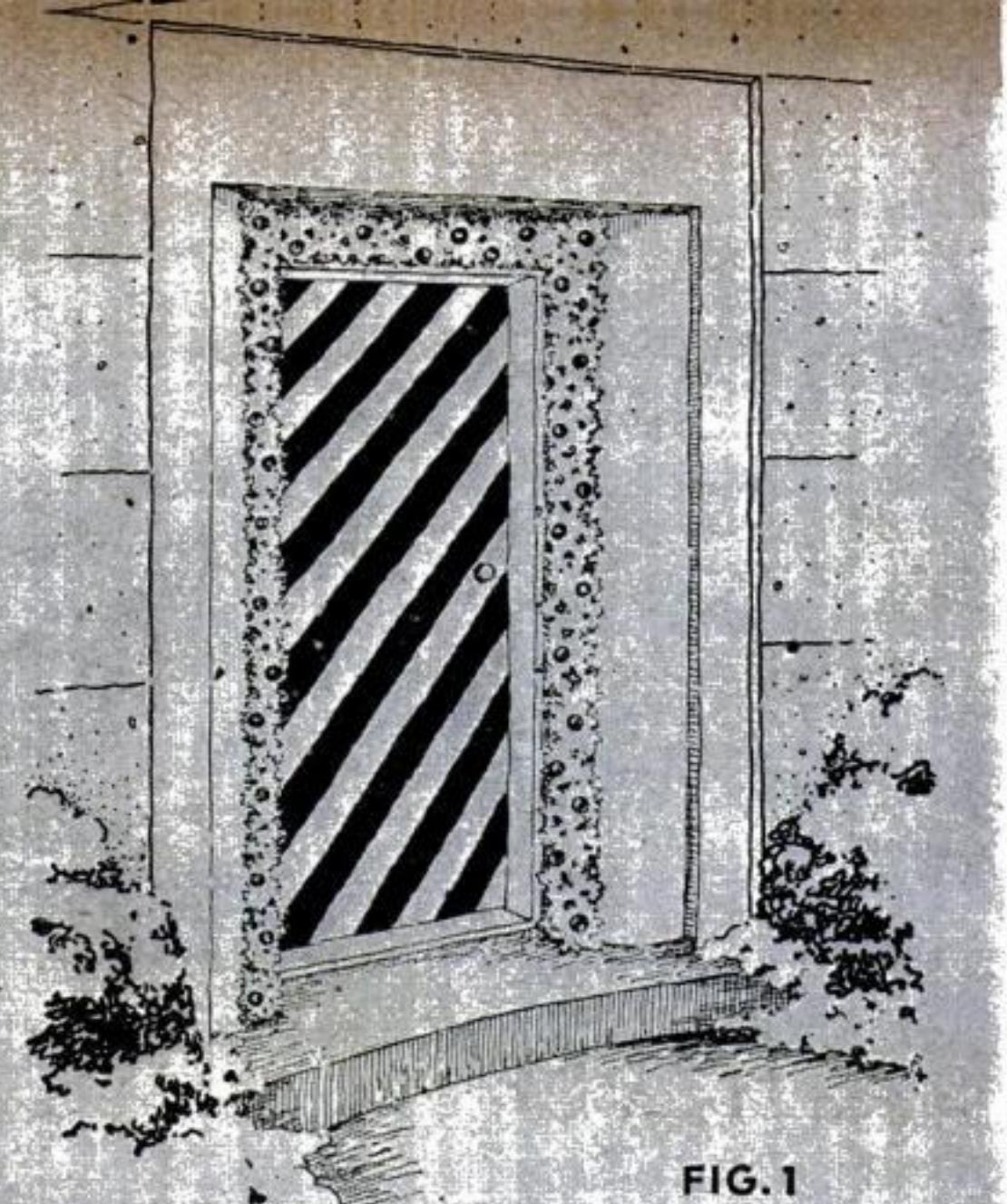


FIG. 1

# B

# uletide



FIG. 3

At top of this page, colored stripes on a false door panel, framed with evergreen roping through which lights are strung. Directly above, window decorations cut from colored cellulose material make a bright display by night, when the indoor lights are on. At right, the charm of a traditional post lantern may be enhanced by a spray of balsam trimmed with lights



# Decorations

MAKE YOUR HOME SAY "MERRY CHRISTMAS"

By HENRY B. AUL

NOW is the time to begin planning something different in Christmas decorations for your house and lawn or garden. The usual multi-colored string of lights and illuminated tree are always pleasing, but perhaps your home possesses architectural features, landscaping, or other characteristics that will lend themselves to a more unusual—and distinctive—treatment. On these pages POPULAR SCIENCE offers a few suggestions that may enable you to make the most of such advantages.

Some home owners paint their doors an appropriate color for the holiday season. If you hesitate to do this, why not fasten a false front of heavy cardboard or composition board to the door? It must, of course, be well fitted to allow the door to close properly. If there are raised moldings around the panels, you may have to insert narrow wood strips under the cardboard to obtain a good fit. Thin brads will hold these, as well as the false panel, in place. Cut holes over the latch, keyhole, and knocker, if any.

Thus prepared, a door offers all sorts of intriguing possibilities in the use of paint, lights, and greenery. Figure 1 illustrates a treatment consisting of 4" wide diagonal stripes of red and gold and a frame of evergreen roping studded with lights. Orange or orange and white lamps will intensify the red and gold of the door and enhance the decorative effect at night. Red lights, however, would deaden the green roping to a brownish tone.

Such a decorating scheme is especially adaptable to doors of modern design. Red and white, silver and blue, or white and gold stripes could be used. A door painted solid blue might be ornamented with silver stars of various sizes applied at random over its entire surface, and further set off with a bunch of foliage accented with tiny silver bells and fastened with a bow of silver ribbon. White floodlights would heighten the effect by night.

If your house has a white Colonial door, it can be strikingly but inexpensively decorated

with a single good-sized wreath fashioned of mixed greenery and cranberries, with one large cluster of shiny English walnuts and pine cones. Perhaps you can hang it on the door with a large red bow of ribbon. A concealed floodlight will make the effect even more striking by night than it is by day.

A novel window decoration is illustrated in Fig. 2. Candy canes, tree ornaments, bells, horns, holly leaves, and poinsettias are cut from colored cellulose wrapping material and fastened to the glass on the inside with rubber cement or bits of cellulose tape. At night the usual room illumination or a small floodlight makes these visible outdoors in full color. By day they show to advantage inside the room.

Post lanterns add a quaint holiday touch when placed beside the walk or near the porch. Usually they are fitted with a red, blue, or green lamp bulb, but their effect may be enhanced by tying underneath the lantern a spray of balsam through which runs a string of small colored lamps, as shown in Fig. 3.

Quite novel, but warm and friendly, is the use of a lighted outdoor tree as part of an outdoor greeting "card." This is illustrated in Fig. 4. The card is made of light boards and lattice strips, painted a bright bronze, gold, or silver. To it is attached the greeting "Merry Christmas," cut out of heavy cardboard or thin plywood and painted a contrasting color.

Mount the card slightly to one side of the tree, pulling the rearmost branches through the latticework so that tree and card appear to be almost in the same plane. Nail the bottom of the frame to stakes driven in the ground, and run light guy wires sideways

from each upper corner to other stakes as shown. A few of the lights at the back of the tree are fitted with tin reflectors to illuminate the card more brilliantly.

The size of the frame will depend upon that of the tree, but it should probably be no more than 6' or 7' high. If twin trees are used to flank a gateway or other entrance, one may proclaim "Merry Christmas" and the other "Happy New Year."

Candles are ever-popular decorating motifs, although for safety and convenience the electric candle has replaced the wax taper almost universally. One can be used in each window, or several can be arranged to form a pyramid of light. Mailing tubes or pieces of stovepipe can be fitted with sockets and set into flowerpots, dish pans or more elaborate holders as lawn and porch ornaments. Very effective also is the single candle placed inside a cottage-type window and flanked by tie-back curtains.

If your door has side lights, you can display vertical rows of electric candles as shown in Fig. 5. These may be placed upon small square shelves fastened to a 1" by 3" upright, which in turn is fastened to the inside wall or door frame so as to be invisible through the side lights. Similar improvised shelves might support candles behind the lights of a transom or in diagonal, vertical, or crossed formations in large windows.

Window boxes can be transformed into decorative high lights. Small trees planted in them may be trimmed with tiny lamps or may conceal banks of colored floodlights that illuminate a decorated window. In the latter case the silhouetted trees will be pierced with an attractive fretwork of light.

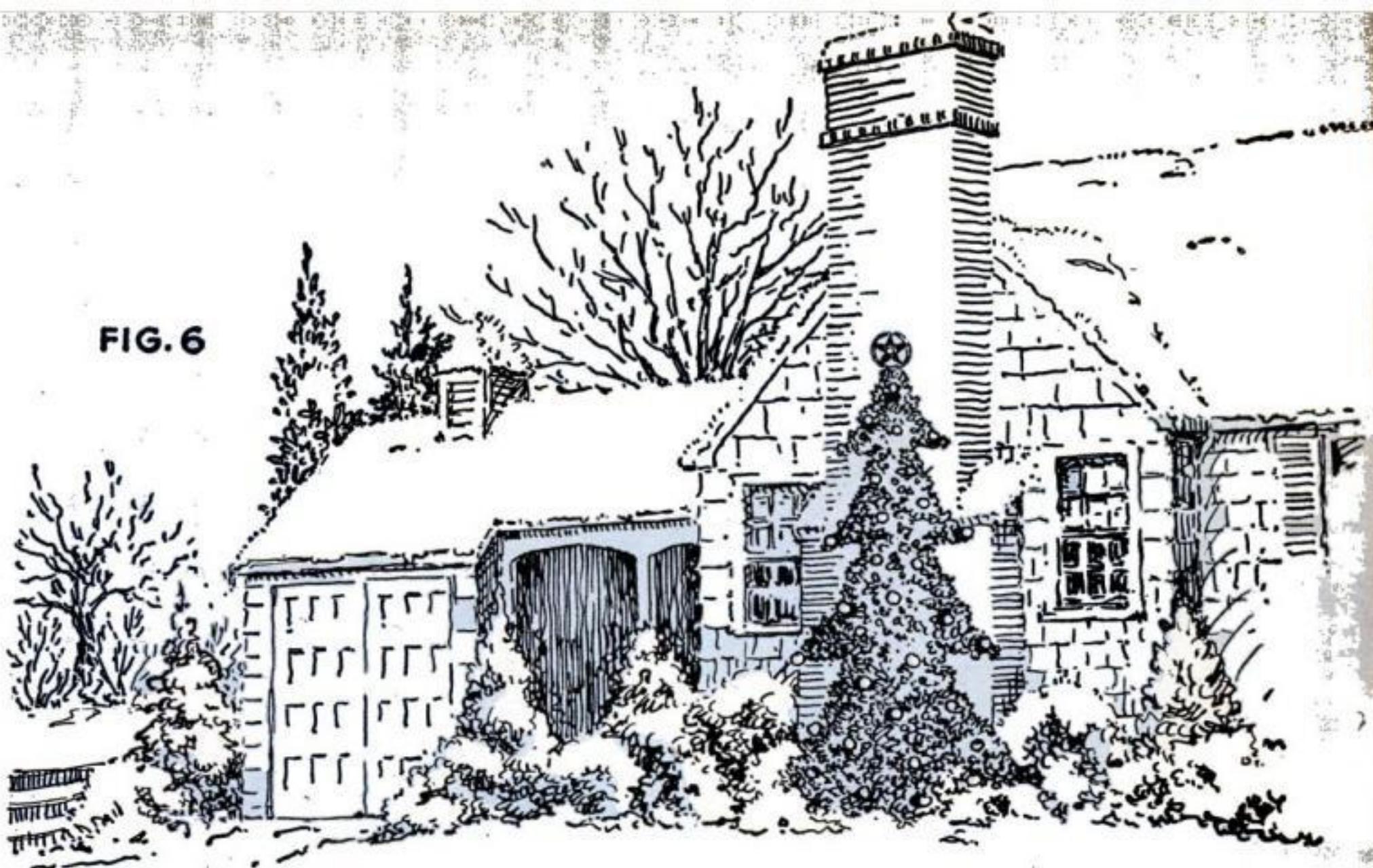
Woven evergreen mats of various shapes, studded with lights, are very effective for trimming bare expanses of wall. A framework of 1" by 2" lumber, covered with light, large-mesh chicken wire, serves as a foundation. Weave in or tie to it balsam branches or small green twigs to make a mat of any desired thickness. Trees, stars, bells and other simple shapes are best. The lamps may be placed to emphasize the contour of the piece, or scattered over the surface. Figure 6 shows an evergreen mat made in the shape of a tree and fastened against a large house chimney. Another good location is between windows. Furthermore, if you have always wanted to trim a big outdoor tree, you can make one in this way as large as you please, and deco-



FIG. 5

Electric candles mounted behind transom or door lights on invisible shelves strike a mellow Yuletide note. They can also be used in various formations behind large windows

FIG. 6



rate it with all the globes and other ornament usually used. Your ingenuity is the only limit to what can be accomplished by this method.

However, outdoor trees will this year probably again reveal a trend toward carefully worked out lighting effects in two or three colors only.

Lamps may be placed in such a way that colors blend slowly into one another. Green, red, or blue may be used around the lower portion, for example, a few white lamps introduced at the middle, and the proportion of these increased until the lighting at the top consists entirely of white, with perhaps a white star at the tip of the tree. Dramatic effects can be worked out in this way by the blending of one color into another.

In choosing colors, remember that green light makes foliage appear still greener, but red lamps darken it to a brownish tone. Orange and yellow lamps lend a mellow touch, and white ones contribute a bright sparkle that accents all other colors. Blue lamps produce a cold and often somber effect. For the traditional tree of many cheerful lights, simply mix all available colors.

Increasingly popular is the idea of decorating latticework around doorways, porches, or fences close to the house with strings of lights. Although the nighttime effect of this is pleasing, little or none of it remains by day. To overcome this defect, first cover the latticework with evergreen roping (Fig. 7), then secure the lamps to this. Star-shaped tin-foil reflectors can be used, if desired, to accentuate the lamps.

Make your own tree to order, as big as you please! Wire netting on a lath framework as shown at the right forms a support for balsam twigs

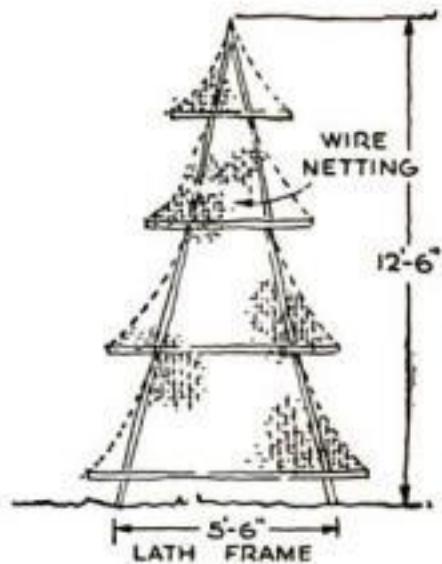
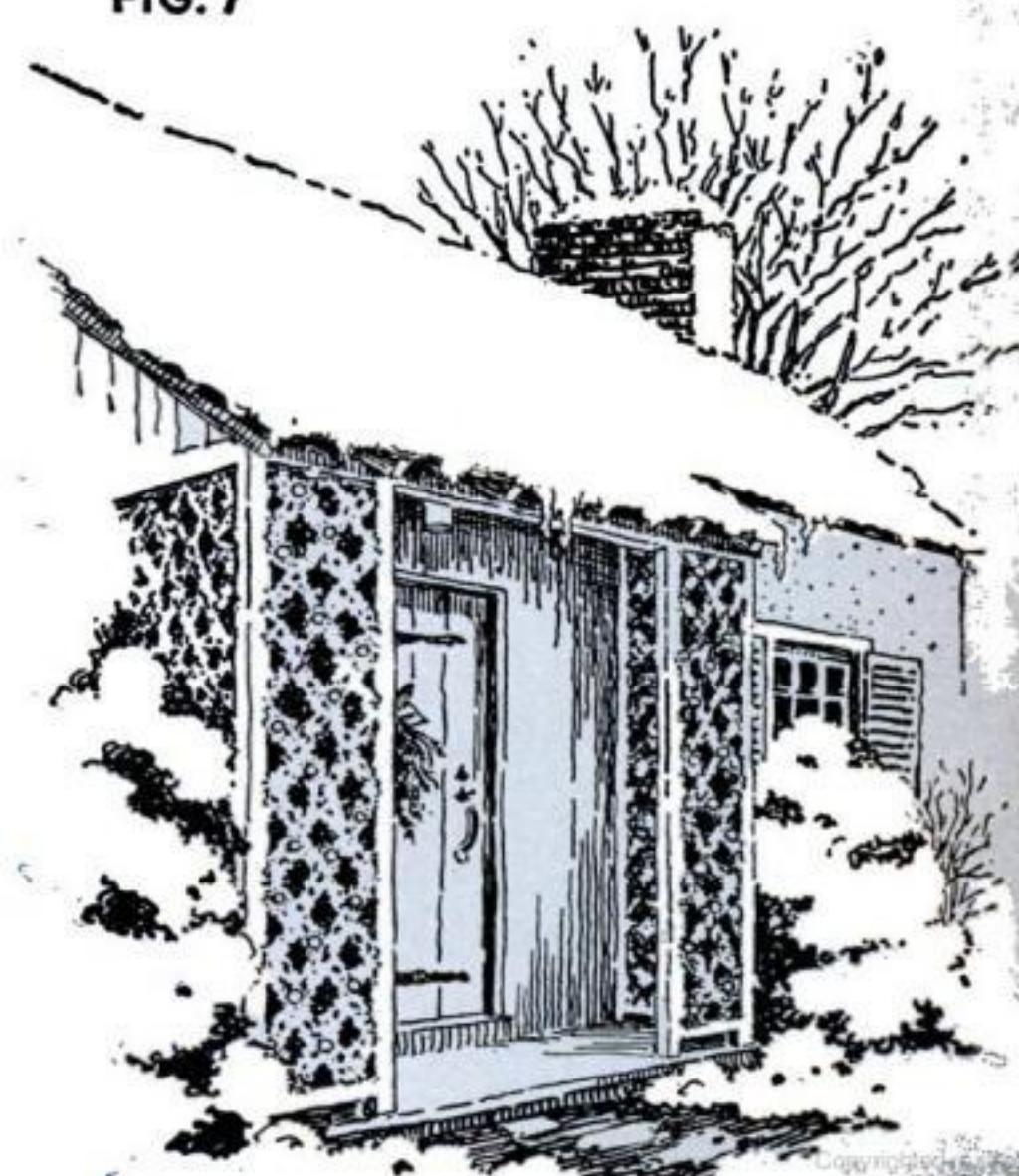
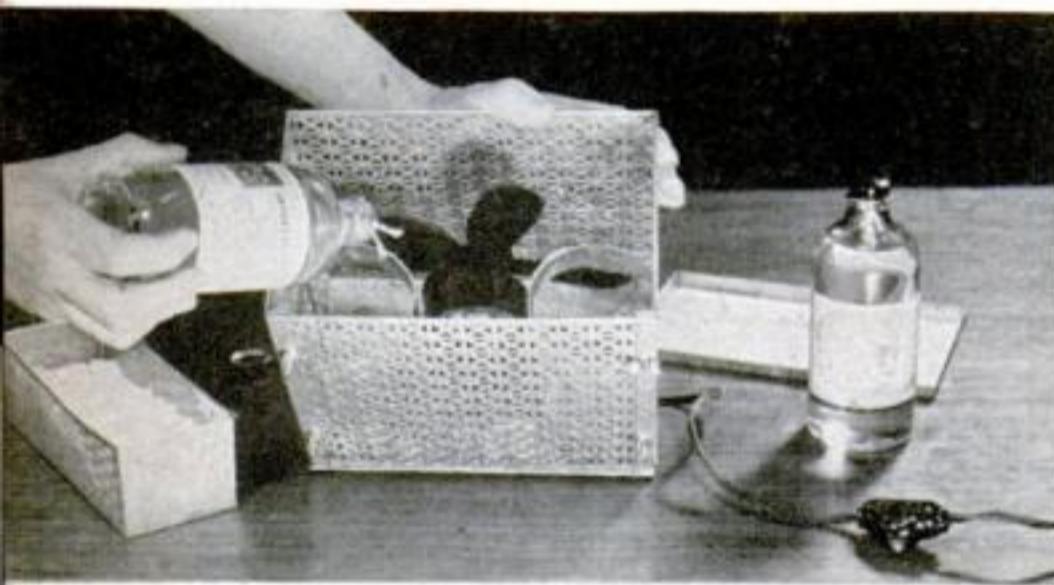


FIG. 7

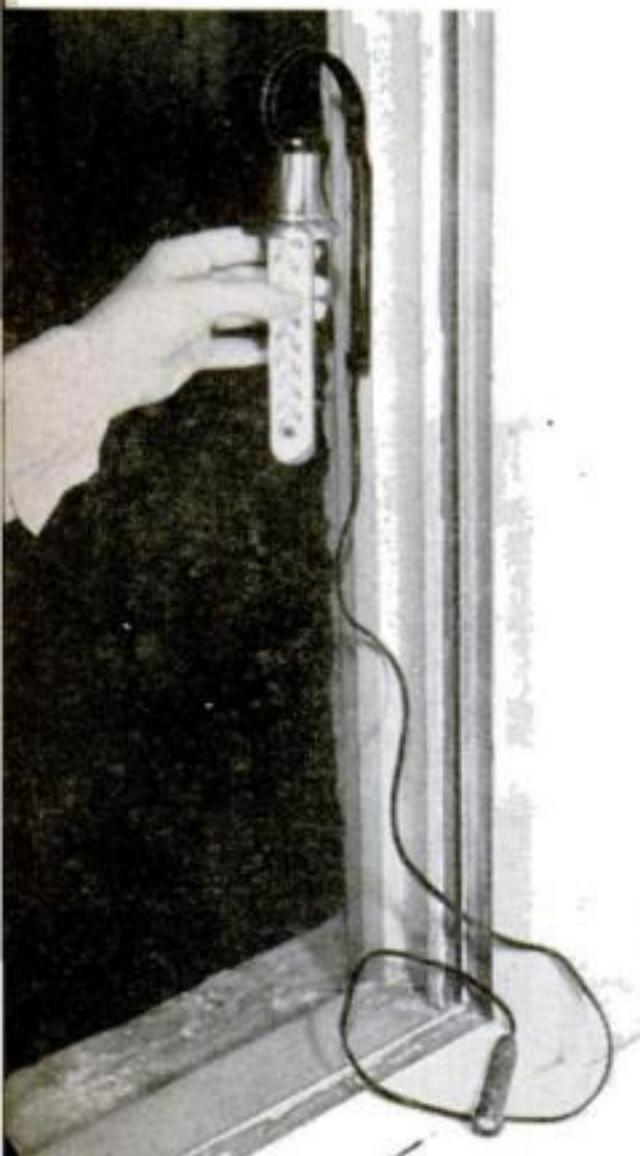


# IDEAS for HOME OWNERS

**WEEDING BECOMES A GAME** with a non-back-breaking weeder that has been put on the market. Stick the prongs on the end of the rod into the weed, twist, pull, and up comes weed and root. Point towards the garden basket, press the trigger in the handle, and shoot. The weed will travel some 8'. Six prongs grab the weed when a disk that holds them apart slides up on a spring as the weeder is pressed against the ground. Mechanism in the rod releases the disk, ejecting the weed, at a pull on the trigger.

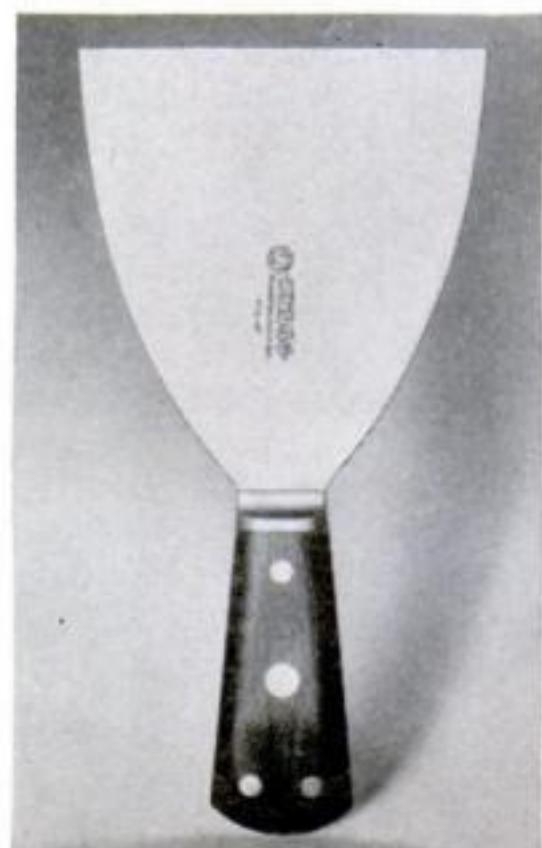


**MOSQUITOES OR MOTHS** are killed, or a kitchen deodorized, through the use of the basket and fan device shown at the left. In demothing a closet, a container fitting in the top is filled with crystal flakes of a standard moth repellent, and the air from the built-in fan circulates through them. The door of the closet should be closed for the best results. The mosquito-repelling and deodorizing fluids are in bottles which have wicks passing through their corks. Either or both are inverted, and the air current circulates the vapors.



**ILLUMINATION FOR AN OUTSIDE THERMOMETER**, shown at left, is provided by an attached battery flashlight controlled by a cord and push button. The thermometer and flashlight are attached to the outside window casing with two screws. The cord runs under the closed sash.

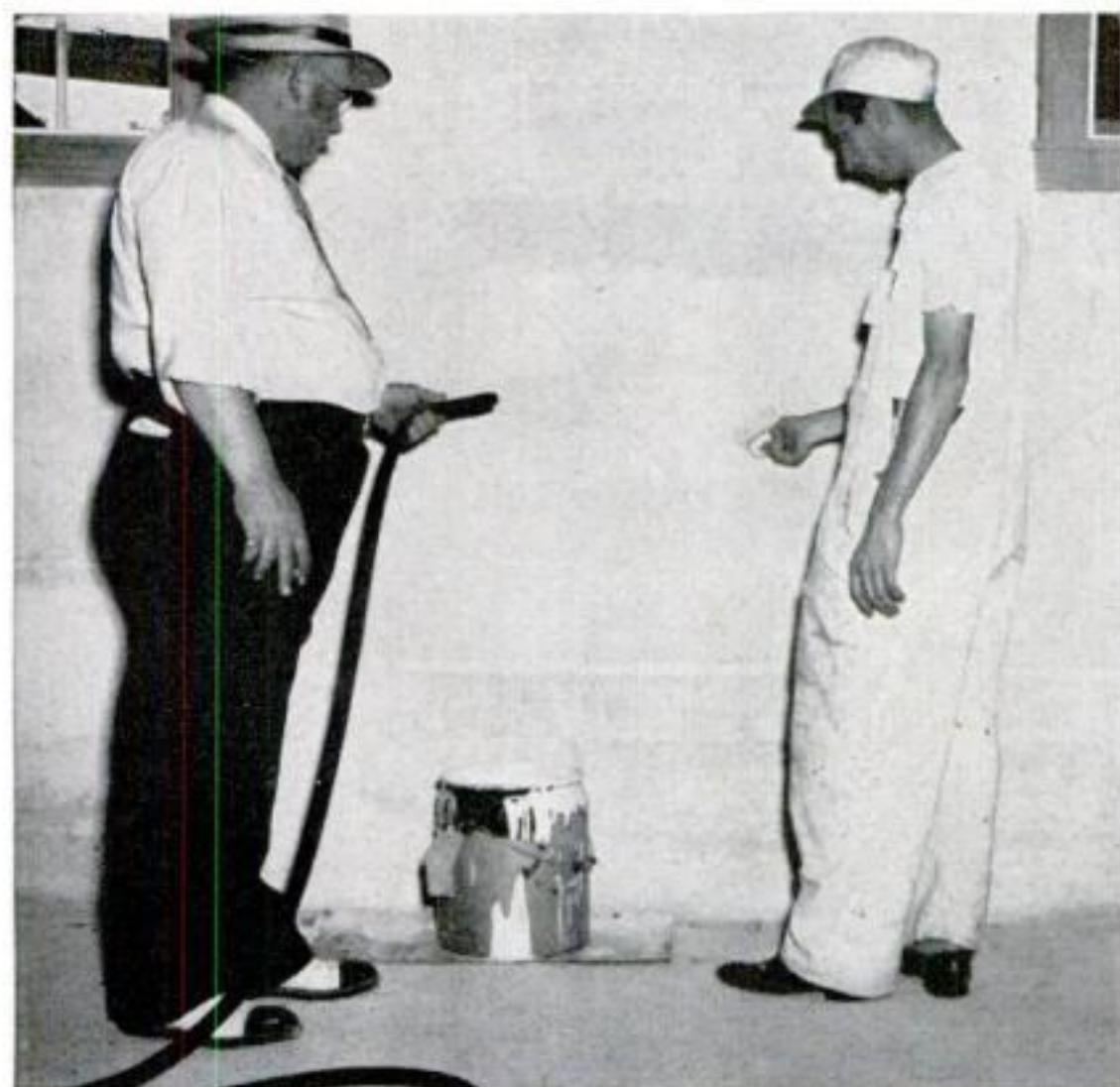
**THIS FLEXIBLE KNIFE** for filling joints between plaster boards, tile boards, and other wall boards, has a 4" blade with a square trowel edge. It is oil-hardened and tempered tool steel, and will bend to a point about  $1\frac{1}{4}$ " from the edge. The tang goes through the handle to the tip, and the handle is attached permanently with four brass compression rivets. An oversize alloy bolster prevents water and plaster from creeping under the handle.



**CONCRETE REPAIRING** is simplified with a ready-mixed patching material that eliminates the necessity of chipping the old surface. The area to be repaired should be cleaned with a wire brush, and a little of the material scratched in with a trowel as it comes from the container. Then it is brought to the desired level and smoothed. For crevices deeper than  $\frac{1}{2}$ ", it should be applied in layers, and each layer allowed to dry partially. Complete drying takes from 2 to 12 hours. Basement floors can be damp-proofed by using a primer and then covering them to a thickness of  $\frac{1}{8}$ " with the cement.

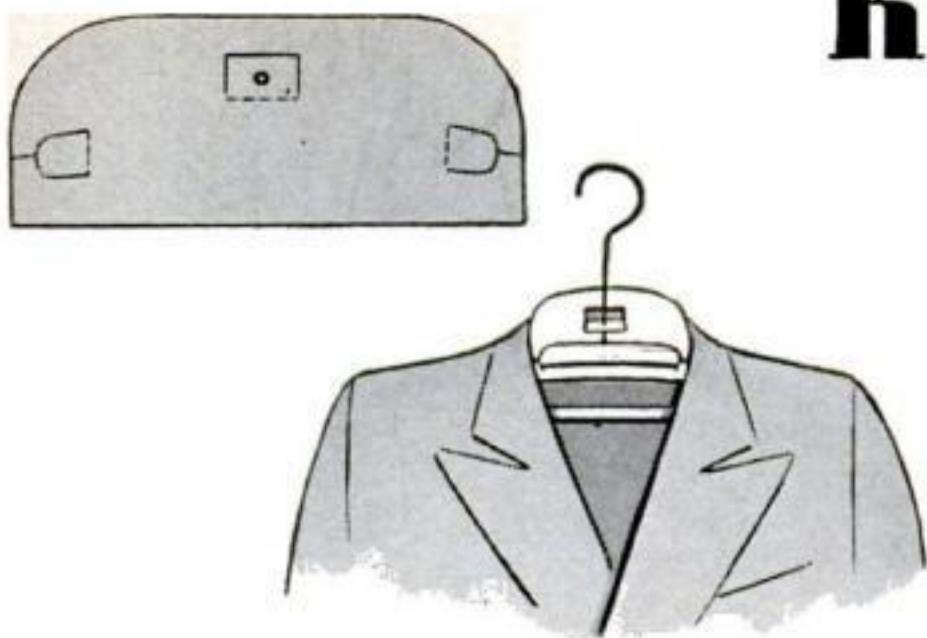


**REFINISHING A GLOSSY SURFACE** without sanding is possible with a new liquid which removes dirt, grease, and wax, deadens the gloss, and leaves the old finish slightly tacky, thus providing a base on which the new finish will bond readily. It is especially convenient for surfaces such as moldings where grooves and other spots hard to sand are numerous. It is not a paint remover and contains no chemicals that will harm the hands.

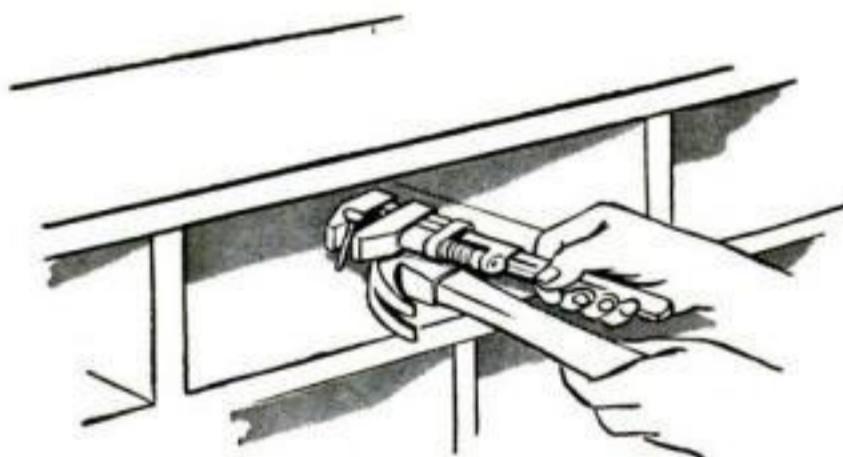


**OIL PAINT THAT "BREATHES"** is used now for painting over new plaster and masonry where formerly, because of the lime or alkali present, time for thorough drying was necessary to prevent deterioration of the finish. This new paint does not seal in the moisture, but allows the plaster to dry out after the finish has been applied. It is said by the manufacturer that finishing can be done the day after plastering, and that the paint itself will dry in about an hour. Once it is dry, it can safely be washed. The paint can also be used over calcimine or whitewash without taking the time and trouble to remove the old finish. Interior and exterior mixtures are available.

# KEEPING THE



Ordinary hangers usually let garments slip sideways, and fail to support the collars properly. A 3" by 6" piece of stiff cardboard shaped as above will keep a hanger centered and prevent sagging of a coat collar. Slip the middle tab over the hook



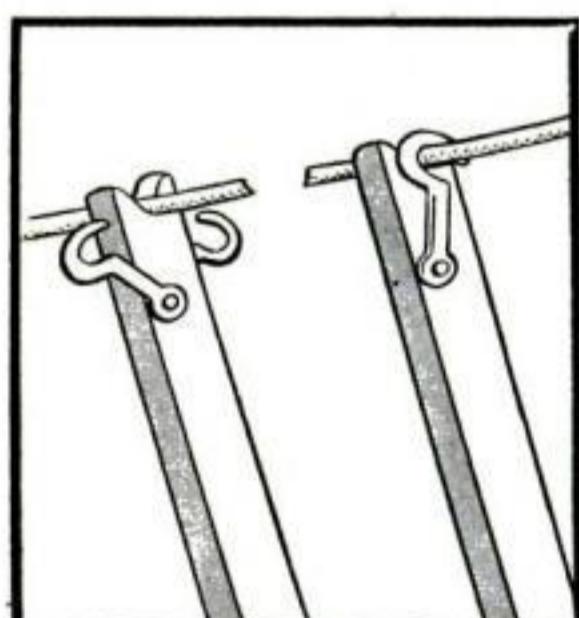
Where space is too cramped to permit using a claw hammer to pull out nails, this can often be done by means of a monkey wrench as shown above. The hammer is used as a fulcrum. Close the wrench jaws under the nailhead, then bear down on the handle



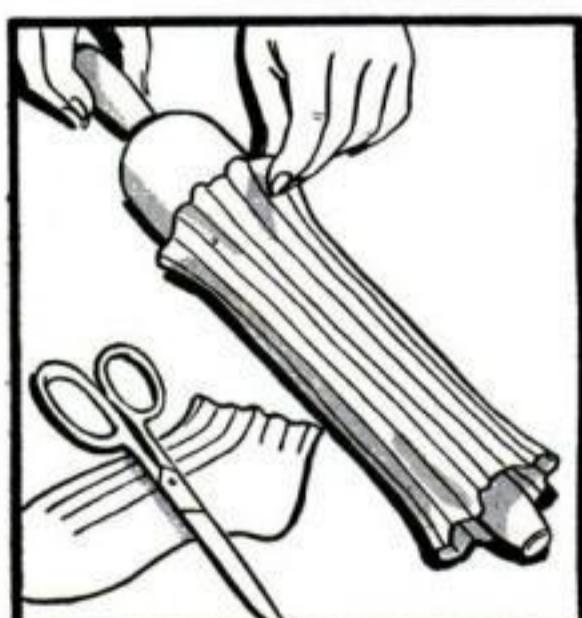
If a vacuum cleaner or attachments for cleaning upholstered furniture are not available, the work can be done with a cloth dipped in clean water and wrung out. Place this over the fabric and tap it gently all over with a flat board. Dust comes to the surface but cannot escape into the air. Wipe off with the cloth, repeating as necessary



Crisscrossed strips of adhesive tape on the bottoms of ash trays will prevent marring of table tops or other polished surfaces



A clothesline pole cannot fall over if fitted with two 2" oval brass hooks as shown. Facing in opposite directions, these hold the pole securely to the line

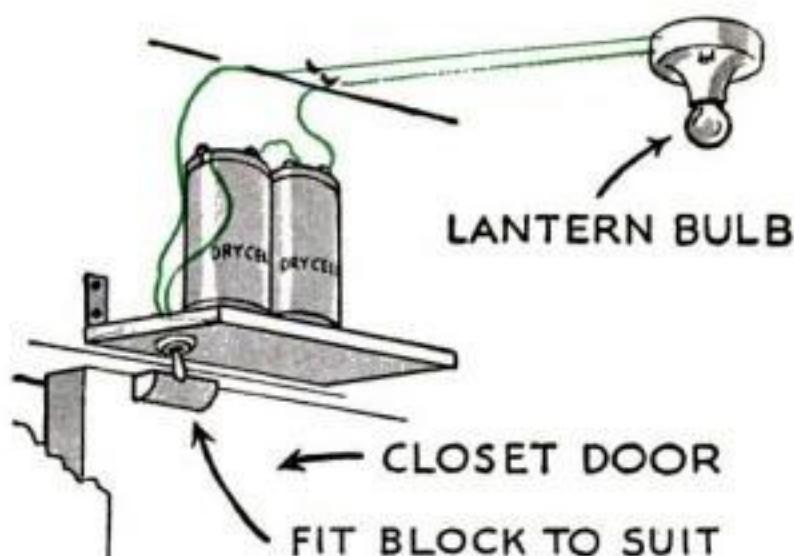


Time is saved in rolling out dough by slipping the leg of a new cotton stocking over the rolling pin, which then requires only one sprinkling of flour instead of several

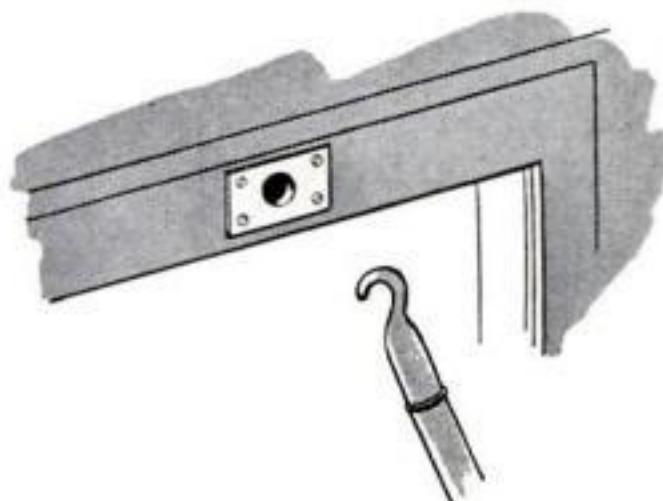
# HOME SHIPSHAPE



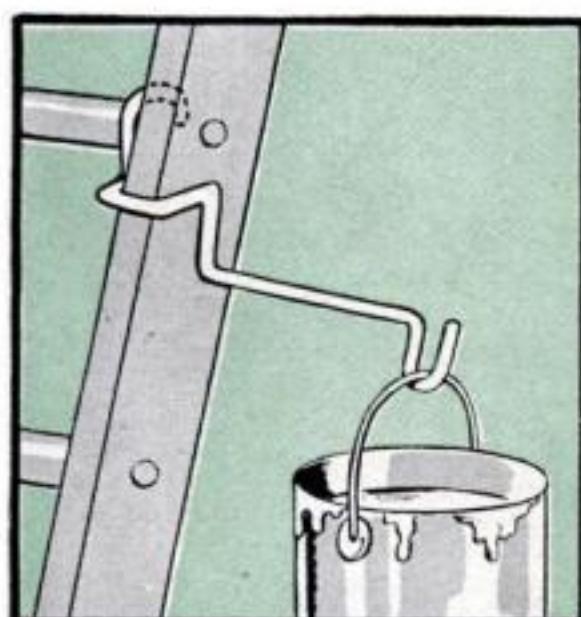
The necessary sizing of walls and ceilings preliminary to papering them can be done by applying the solution with an ordinary household sprayer such as is shown above. This method is speedier than using a brush, produces a more even coating, and causes less dripping on floors and baseboards. An orchard or garden sprayer could also be used.



You can fit a dark closet with a simple semiautomatic light by mounting a radio toggle switch on a shelf inside the closet as shown. Use two No. 6 dry cells and a large 2.4-volt bulb of the type sold for electric lanterns. The switch is turned on by hand, but snaps off when the door is closed.



School and office windows are often broken because the window-pole sockets cannot be seen against the glare of outdoor light. Painting the socket plates white makes them visible against dark sash frames even on very bright days. Do not paint the sockets.



A paint-pail holder to hook over round ladder rungs is made by bending a 21" length of  $\frac{1}{4}$ " iron rod to the shape shown. For light cans, you can use an old curtain rod.



To make the cut end of a piece of stovepipe fit into another, grasp the edge with long-nosed pliers and twist slightly. The crimps should be evenly spaced.



If the encrusted cap of a glue can is pressed on in an inverted position, fresh glue will flow down and form an air-tight seal.

# Two Craftwork Novelties

DESIGNED BY JUAN OLIVER



**VAQUERO PENHOLDER.** A South American *vaquero* on a balky horse provides the amusing decorative motif of this useful penholder. The piece can be made in about three hours

and is an excellent gift project.

Band-saw horse and rider together from  $\frac{3}{4}$ " thick mahogany or other hardwood. With a knife or carving chisel, cut back the wood to outline the various parts as indicated.

Bevel the mane of the horse and taper the tail toward the body. Shallow holes represent the animal's eyes. Drill other holes on each side of the face and in the *vaquero*'s hands to receive the reins, which are short pieces of  $1/16$ " brass or bronze rod. Sand or file the hind feet flat for mounting at the correct angle.

Saw the base from  $\frac{5}{8}$ " stock to the smooth, irregular contour shown. The edges may be beveled or left flat. Use  $\frac{1}{2}$ " ma-

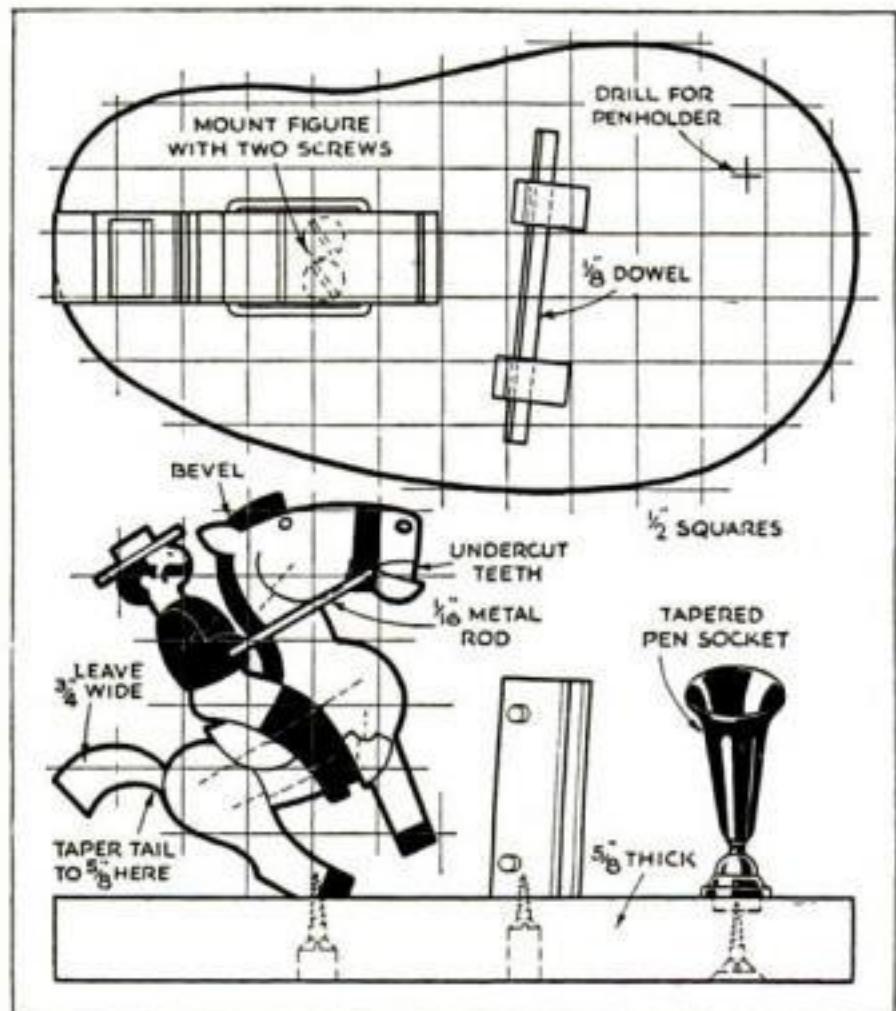
terial for fence posts, and  $\frac{1}{8}$ " dowel for the rails.

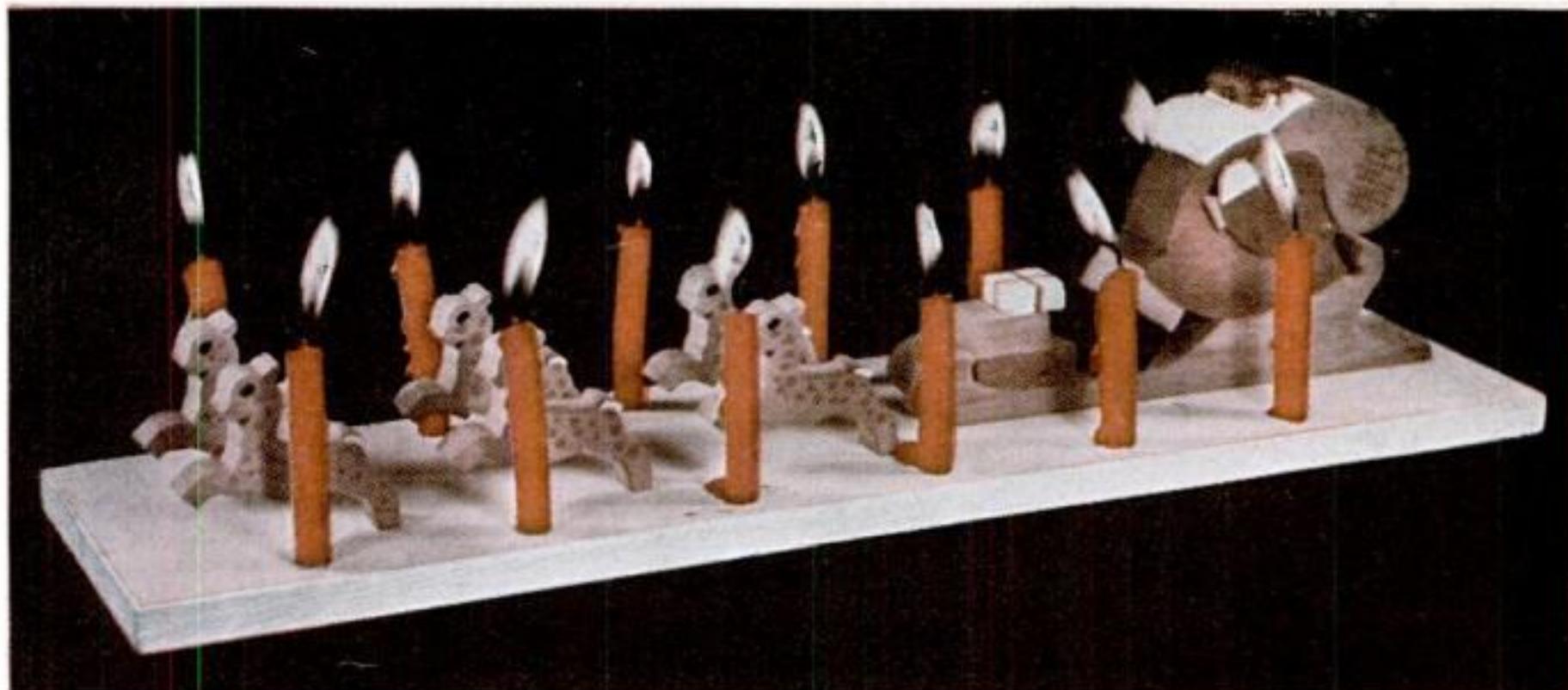
After sanding smooth, give all parts two thin coats of shellac. If desired, this may be rubbed down with fine abrasive paper and waxed. Accent the mane, bridle, nostrils, and hoofs, as well as the *vaquero*'s shirt, trousers, and face, with flat black paint. Use white to set off the horse's teeth and forehead, the stirrups, and the cowboy's hat.

Fasten all parts to the base with countersunk wood screws. The pen socket, which may be taken from a discarded desk set or purchased new for a small sum, is mounted by means of a single machine screw.

**SANTA CLAUS CENTERPIECE.** Cleverly stylized little deer and a simplified figure of jolly old Santa Claus on a loaded sled, flanked by twelve miniature candles, comprise this attractive Christmas centerpiece for dining table or mantelpiece. Construction is for the most part simple scroll- or band-saw work, although the carving may be carried out more elaborately if the maker wishes.

By means of squares, draw the profile of the sled and figure on  $1"$  mahogany or other closely grained wood. The boxes piled on





Flaming candles, a jolly Santa Claus, and stylized deer add this Christmas touch to the table or mantel

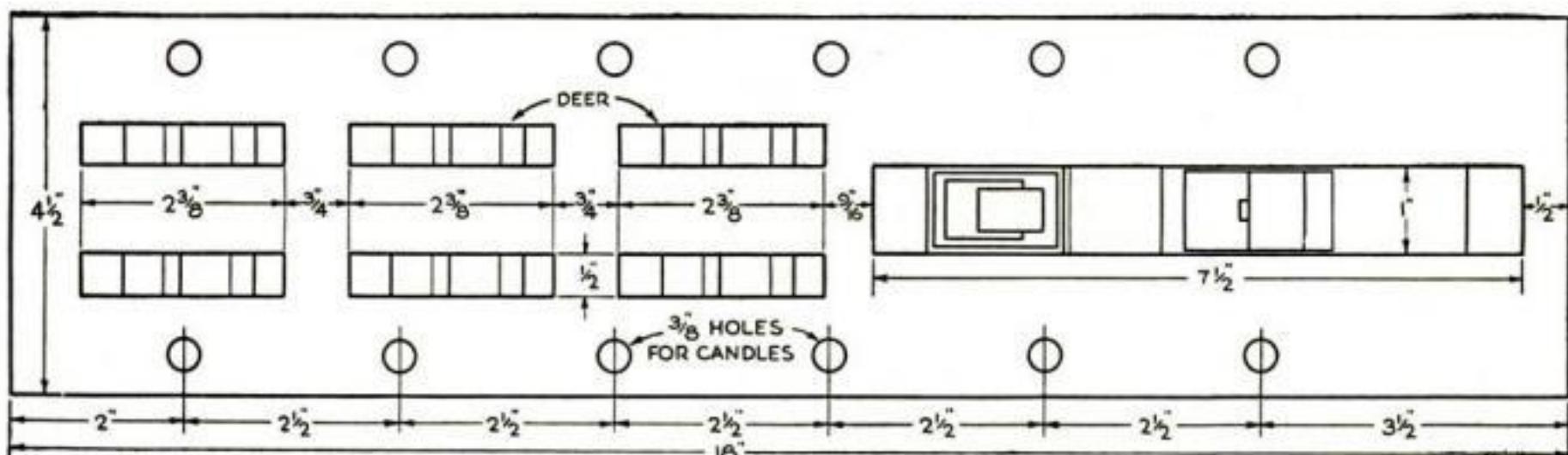
the sled can be cut out from the same piece, or may be simple blocks glued on separately. Note the space under the heel through which the band-saw blade may enter to cut the inner line of the leg, coat, and seat.

The various offsets marked on the drawing can be undercut with a sharp knife or wood-carving tools. Cut only far enough back to produce the desired effect. Saw the six deer from  $\frac{1}{2}$ " material. These require no carving of any kind if carefully sawed to shape.

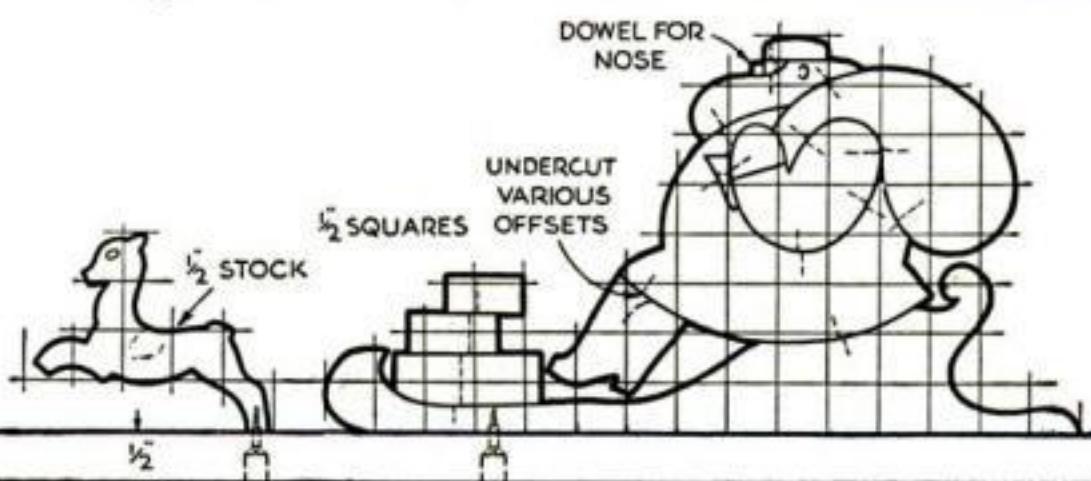
In a  $\frac{1}{2}$ " by  $4\frac{1}{2}$ " by 18" baseboard drill twelve evenly spaced  $\frac{3}{8}$ " holes for candles. Paint this base with flat Japan color or eggshell enamel. White was used for the origi-

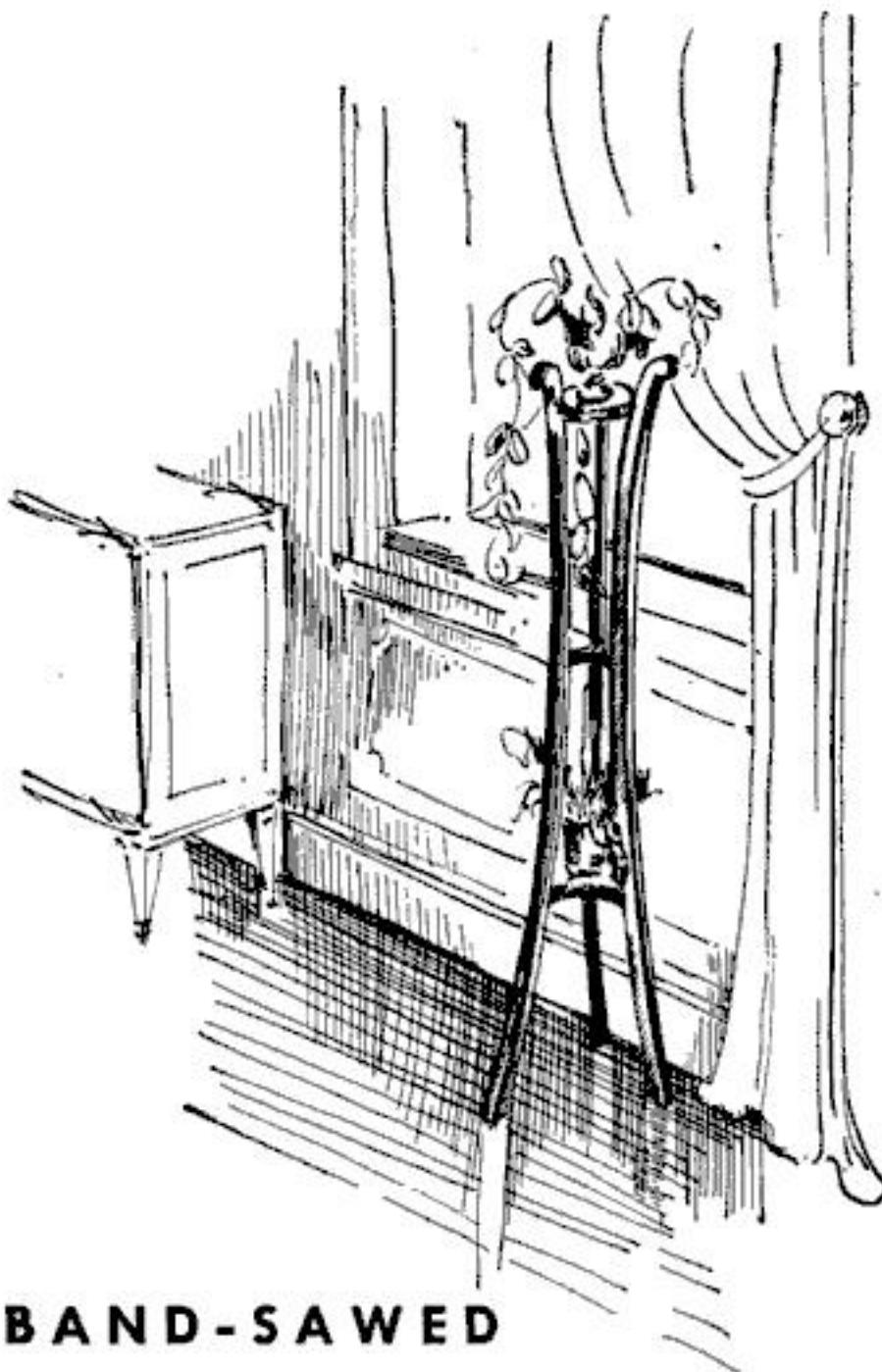
nal, as well as for Santa Claus's beard, hair, and hands. The topmost of the three packages also was painted white, with crossed red stripes to represent ribbon wrapping. Use black for Santa's boots and for the eyes of the deer, marking the tails of the latter with a touch of white. Shellac or varnish may be used to accent parts of the figure and to produce tawny little spots on the deer.

The remaining parts may well be left the natural color of the wood, as in the original. If desired, narrow ribbon traces can be strung between the animals and led back to the front of the sled, but do not let these hang where the candles may set them afire.



Careful sawing will eliminate the necessity for much carving, though there must be some offset work on the Santa Claus and sled. White, black, and red paint, and varnish or shellac, will complete the job





**BAND-SAWED**  
***Flower Stand***  
**IN REGENCY STYLE**

RARE is the home that has not some spot where flowers or a living plant may be displayed to advantage. If a stand is used for the purpose, however, it should be unobtrusive. The simple, dignified lines of this design, reminiscent of the Regency style that happens to be in popular favor at the present time, also make it an easy piece to build, even for beginners.

For a natural finish, mahogany would be a suitable material, but less expensive woods will serve. You will need one piece  $\frac{3}{8}$ " by 10" by 42" to band-saw the legs from, one turned or sawed disk  $\frac{3}{8}$ " by  $5\frac{1}{2}$ " in diameter, and two pieces of the same thickness  $3\frac{3}{4}$ " and  $5\frac{3}{4}$ " square respectively. While the legs can be cut with the least waste from a piece 10" wide, as suggested, narrower stock will, of course, serve just as well.

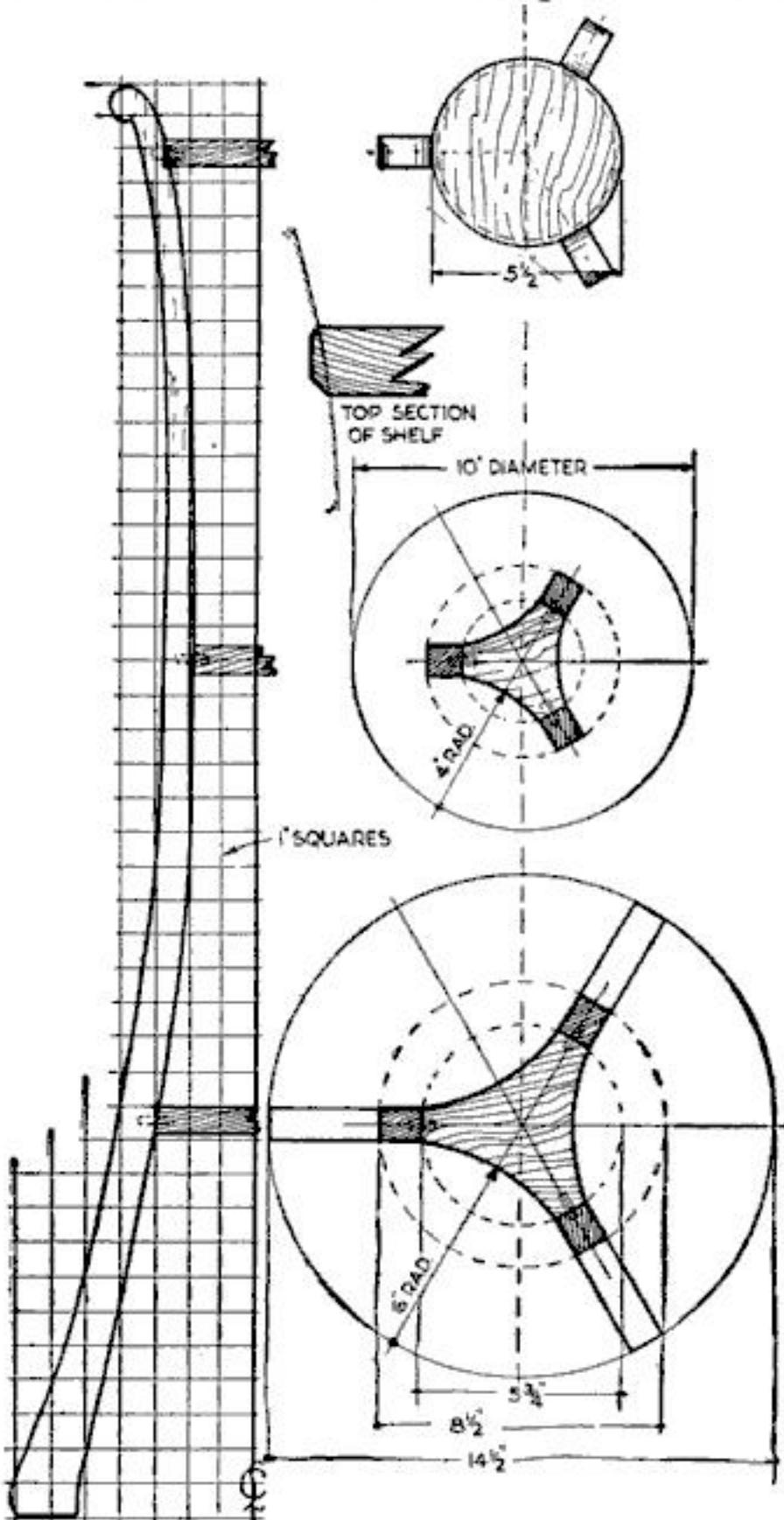
Lay out the legs by means of squares, saw them out, and round off the edges. The patterns for the middle and bottom shelves are laid out by means of compass curves. If desired, the under edges of all three shelves may be beveled about  $\frac{1}{4}$ ". Cut shallow dadoes into the legs and glue in the shelves with

**A Great Furniture Designer  
Offers to Help You**

THROUGH POPULAR SCIENCE you have at your service one of the foremost modern furniture designers — Joseph Aronson of New York. If there is any special piece of furniture you would like him to design, he will gladly include the plans in his present series of articles, provided, of course, that the project is of a type to interest a reasonable number of other readers. Write him in care of the Home and Workshop Department.

a single dowel pin to strengthen each joint.

It is also compatible with modern style to paint such pieces as this. Typical colors are black, off-white, dark green, or light gray. A fine gold stripe along the edges of the legs, if expertly applied, enhances the effect. Pairs of stands are being used in symmetrically balanced rooms to support candelabra or ornaments as well as plants.—J. A.



# Handsaws AND HOW TO USE THEM

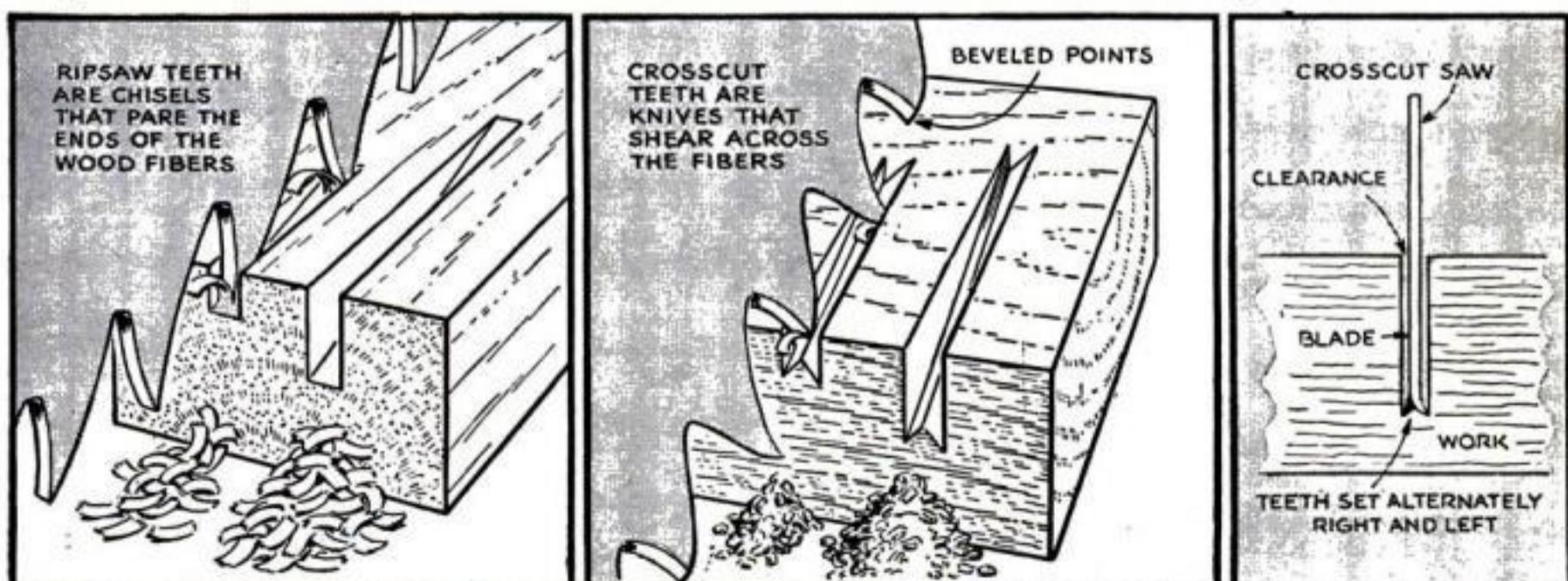
At right, ripping a long board. Your position should allow you to see both sides of the saw in order to follow the line accurately. Below, ripping a short board on a bevel. Move the work forward gradually to avoid cutting the support



By EDWIN M. LOVE

MACHINES, versatile though they are, can never displace hand tools altogether in even a well-equipped workshop. Large or oddly shaped work sometimes cannot be handled on a machine. Pieces partially assembled may have to be completed by hand, and, of course, much jobbing and carpentry work is done outside the workshop with limited equipment. Some skill in the use of hand tools is therefore requisite. Of all such tools, handsaws are among the most useful, and the mastery of them will not only afford the craftsman a great deal of satisfaction, but will also give him added confidence to meet any special problem that may arise. If good

Fig. 1. How ripsaw and crosscut teeth work. Both are set to cut a kerf wide enough to clear the blade



handsaws are added to the tool kit from time to time as the need for them arises, and properly cared for, they will invariably prove a wise investment.

#### What types of handsaws are needed?

**C**HIEFLY ripsaws and crosscut saws, supplemented by the keyhole, compass, coping and turning saws for curved work, and by the backsaw and dovetail saw for joinery.

#### How do a ripsaw and a crosscut saw differ?

**N**EFFECT, the teeth of a ripsaw constitute a row of chisels that slit a board lengthwise. A crosscut saw has teeth with inclined and beveled edges; these shear across the grain of the wood much like knives. Figure 1 illustrates both types of teeth, which are in both cases bent or "set" alternately to right and left, so that they will cut a kerf wider than the thickness of the saw blade. It will be seen that the bottom of a ripsaw kerf is flat, but the kerf of a crosscut saw has a ridged bottom. The blade of a good saw is usually tapered in thickness from the toothed edge to the back for additional clearance, so that it will be less likely to bind in the kerf.

#### How is a ripsaw used?

**T**O RIP a long board, lay it across two sawhorses and hold it down with the right knee, as shown in Fig. 2 and in one of the photographs. Grasp the saw handle with

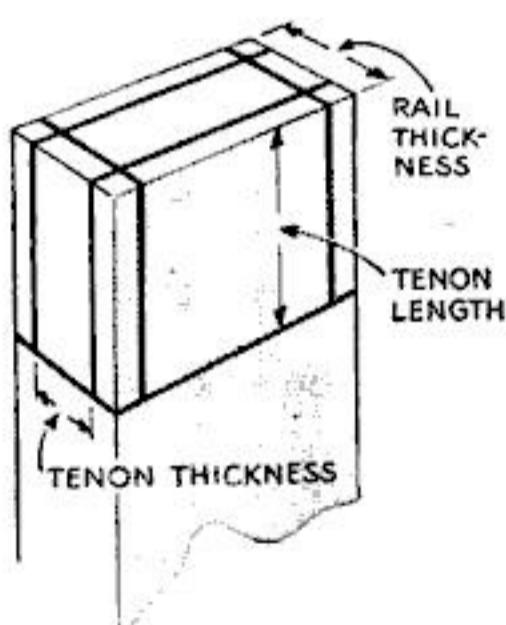
the forefinger lying along one side. Place the other hand at the end of the board so that the thumb guides the saw blade at the start of the cut (Fig. 2). It is preferable to start with a down stroke of the blade, which thus immediately cuts a groove. Starting with an upstroke may cause the saw to jump from the mark. Continue sawing with steady, full-length strokes, being careful not to draw the blade back so far that it jumps from the kerf, as this may thrust it against the work elsewhere and possibly kink the blade. Do not force the saw at any time; little or no pressure beyond the weight of the blade is necessary for rapid cutting.

The right shoulder and elbow and the saw blade should lie in the same vertical plane, and your position should be such that you can see both sides of the saw. Practice will make this stance instinctive. The line of travel of the teeth should be about 45 deg. A stroke more closely approaching the vertical would cut across the fiber ends too abruptly, and cause excessive splintering at the bottom of the kerf; a more horizontal stroke would bring the teeth in contact with too large a cross section of the work and cause slow cutting. If the board is to be jointed, rip it from  $1/32$ " to  $1/16$ " outside the line to leave a little extra stock.

When you have ripped far enough, shift the work so as to continue sawing between the sawhorses, but keep the latter closely enough together to prevent the work from whipping up and down, which would make accurate cutting impossible.

Bevels are ripped by sloping the saw sideways at the required angle, as is illustrated

## MORTISE-AND-TENON JOINTS [ WOODWORKING ]

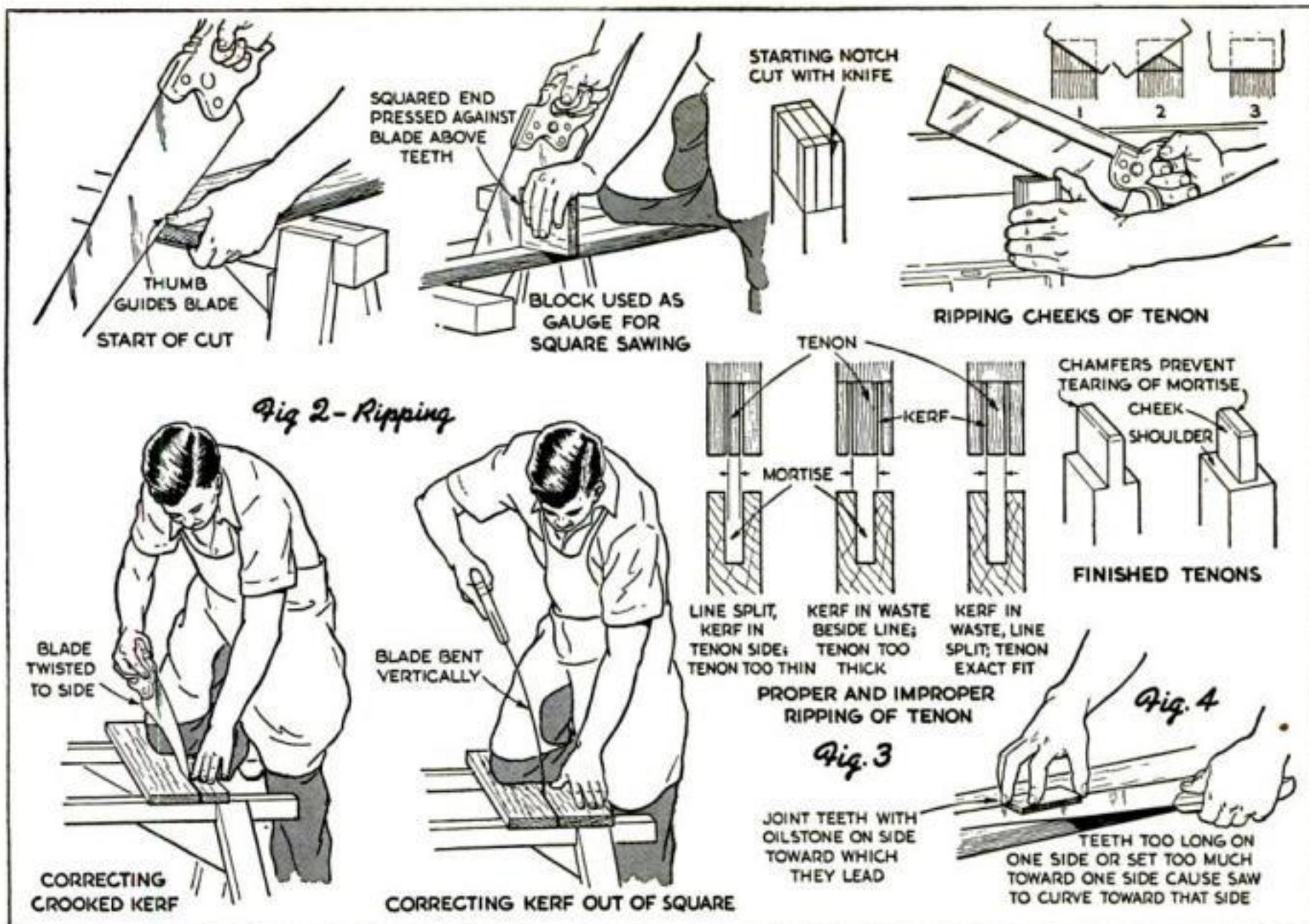


When drawings fail to give dimensions of tenons or a craftsman is designing his own furniture, the following proportions will insure strong joints:

Rail thickness	$\frac{5}{8}$ "	$\frac{3}{4}$ "	$\frac{7}{8}$ "	$1\frac{1}{8}$ "	$1\frac{1}{2}$ "	2"
Tenon thickness	$5/16$ "	$3/8$ "	$5/8$ "	$1/2$ "	$5/8$ "	$3/4$ "
Tenon length	$3/4$ "	$1\frac{1}{4}$ "	$1\frac{1}{4}$ "	$1\frac{1}{2}$ "	$1\frac{1}{2}$ " to 2"	$1\frac{1}{4}$ " to 3"

**Note:** Where a tenon is not under much strain, its thickness may be one third that of the rail; many mechanics, in fact, prefer that proportion. The width of a tenon should rarely be more than six times its thickness. Wider joints weaken the mortised part too much, and excessive shrinkage is likely to break the glue bond between the parts. On wide rails, use a double mortise-and-tenon joint consisting of two ordinary joints side by side.

The rail shown is marked out for a shouldered tenon, which will have two faces and two edge shoulders. Plain tenons, which should be used only on less exacting work, are the full width of the rail and therefore have two shoulders, the face cheeks only being cut away.



in one of the photos on a preceding page.

#### Can a faulty cut be corrected?

**Y**ES. If the cut has wandered from the line, twist the saw handle to the right



Cutting plywood with a crosscut saw. Hold up the sawed edges behind the blade to prevent binding

or left as shown in Fig. 2 until the deviation is corrected. To true an out-of-square cut, bring the blade up to an almost vertical position, and spring it to one side while continuing to saw. The kerf may be tested for squareness by placing a try-square or a block of wood against the blade and the work. A squarely cut wood block can also be used as a ripping gauge in the manner shown in Fig. 2.

#### What is the secret of sawing a straight line?

**A** SAW in perfect condition, properly used, will cut a straight kerf almost of itself. The correct stance and a steady hand are, of course, essential. However, if a saw persistently wanders from the line in the same direction, the teeth on that side may be too long or may have too much set. If examination proves this to be the case, the condition may be corrected by jointing the teeth on that side with a fine oilstone (Fig. 4). This should be done cautiously and only after it has been determined that the saw is really at fault.

#### Why may a blade bind?

**I**NSUFFICIENT set, forcing the saw, working with poorly seasoned wood, or changing the angle of the kerf, may cause binding.

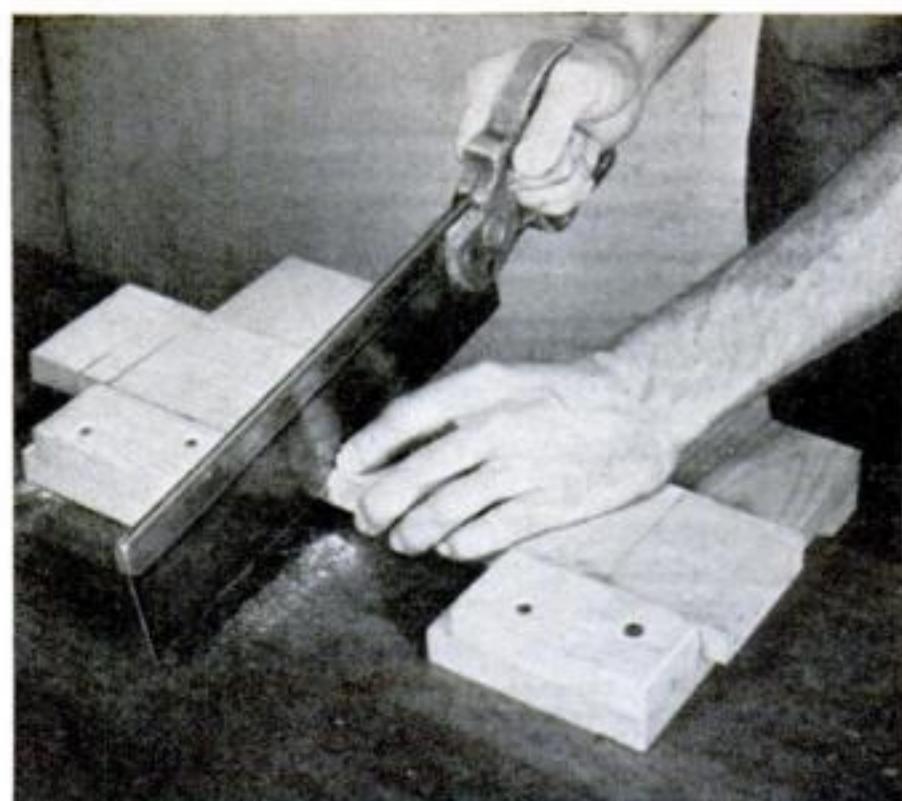
The weight of the saw itself usually provides enough pressure on the teeth for normal cutting, although up to a reasonable limit a little extra pressure will speed the work. The remedies for these conditions are obvious, but sometimes a cut can be finished by pushing a wedge into the kerf to hold it open, or by greasing the saw, or both. However, oil or grease should not be used in sawing parts that are to be glued together, as it may destroy adhesion between the wood and the glue.

#### How are short boards ripped?

**A** N ACCOMPANYING photograph shows a short work being ripped at a bevel on a sawhorse. The vise also may be used. When possible, place the work at a 45-deg. angle and use the saw with a horizontal stroke. In sawing work held vertically, try to retain the full length of the stroke, using a free arm motion from the level of the hip. It is often wise to gauge the stock on both sides. If the kerf becomes out of square, it can then be corrected by turning the work over and sawing from the other side.

#### What is the right way to use a crosscut saw?

**E**XCEPT that the cut is across the grain, the work is very similar to ripping. Support the free end of the stock with one hand to prevent sagging, which might cause the blade to bind, and use very little pressure on the last strokes, holding up the part being cut off in order that it may not fall prematurely and splinter the edge. Short work can be held on a sawhorse, on the bench top with bench hooks, as shown in one of the photographs, or in a vise.



Using a backsaw to cut a dado. The work is held by means of two bench hooks. Tenon shoulders are cut in the same way after the cheeks are ripped

#### How is a tenon cut?

**A** BACKSAW is usually used because of its thin blade and rigidity, although a ripsaw also works well, especially on wide stock. Clamp the work in a vertical position so that the lines gauged on the end and edge can be seen easily. As the cheek cuts are started by sawing at an angle, some workers prefer to fasten the work in the vise at about 45 deg., keeping the saw blade horizontal. Cut a starting notch on the near edge with a knife, and guide the saw in this so that the cut splits the line, with the kerf in the waste stock. Saw diagonally downward to the shoulder, then reverse the work and saw diagonally to the opposite end of the shoulder, and finally finish ripping the

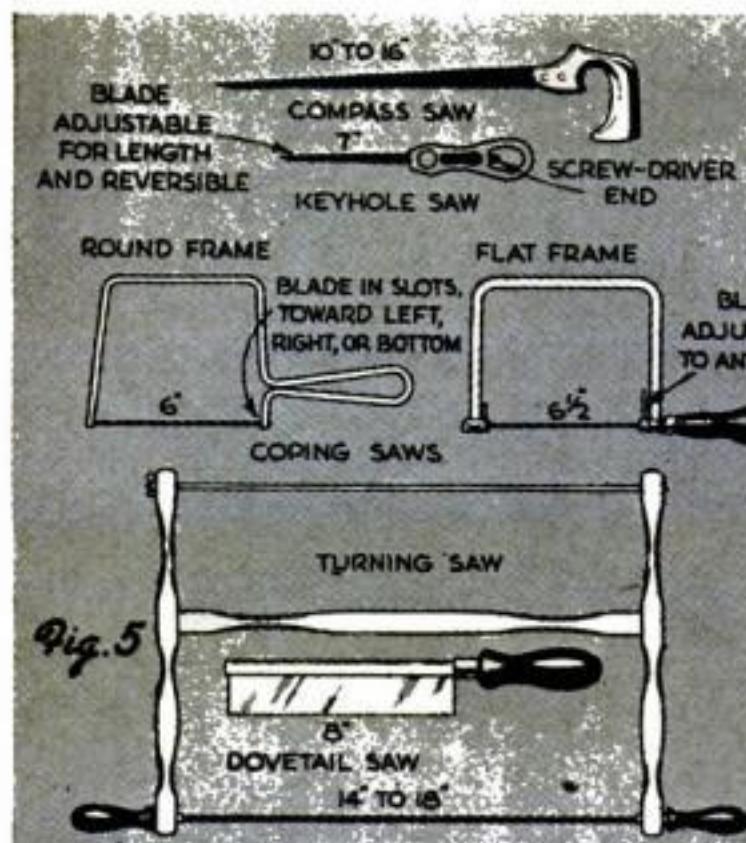


Fig. 5

Saws for Curved Work

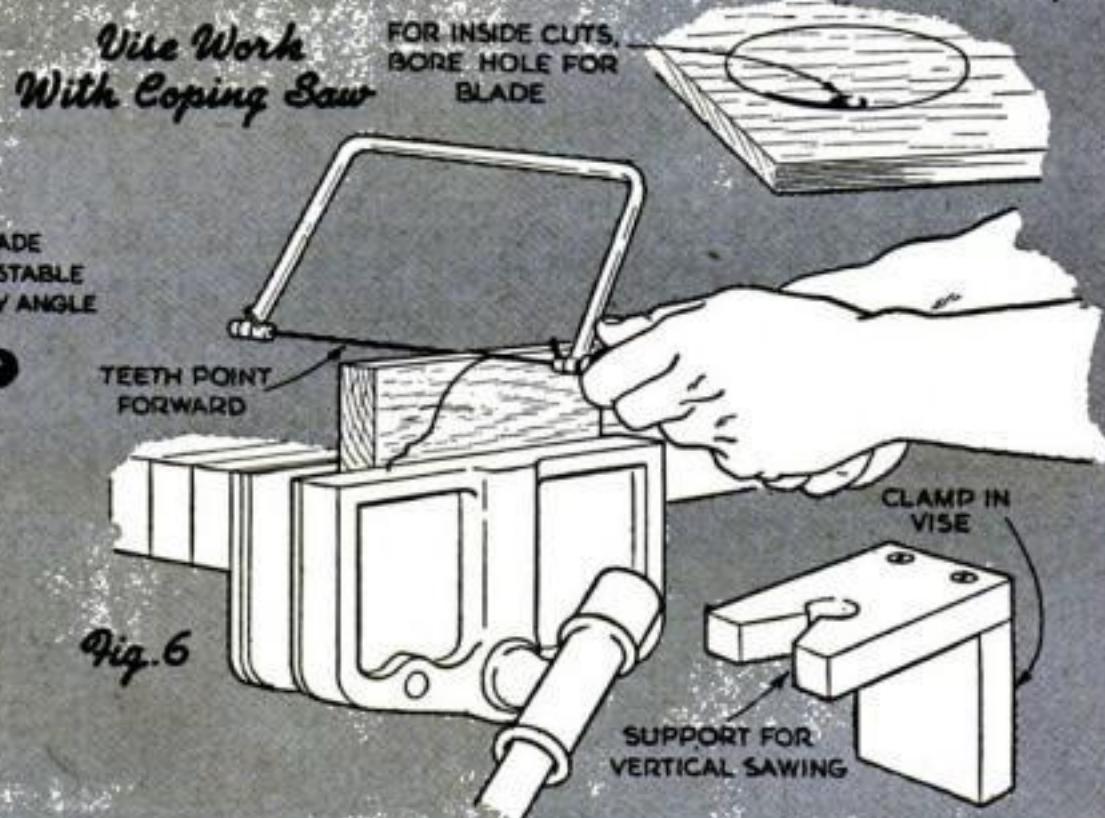
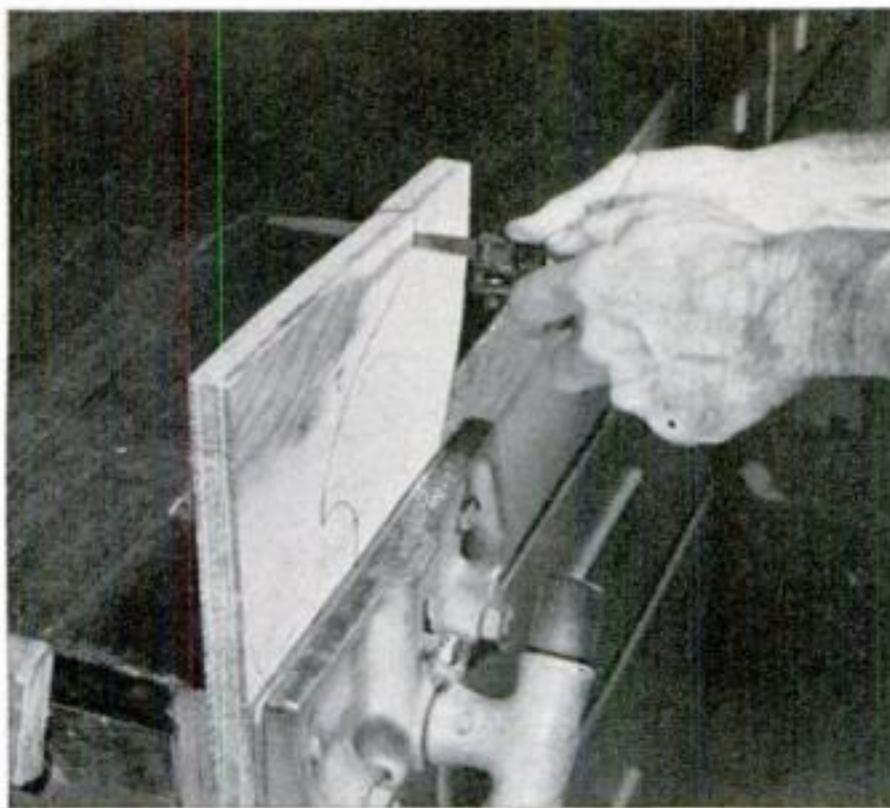
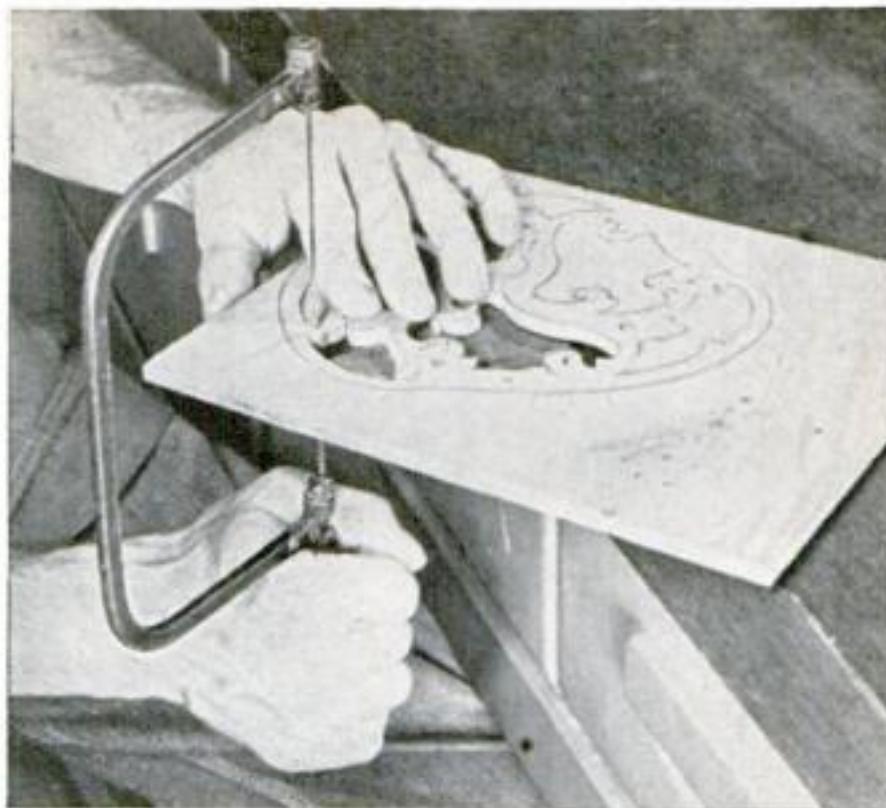


Fig. 6



The keyhole saw is used for curved cuts in heavy stock or in pieces of such a size that it is impossible to employ any kind of saw having a frame



Intricate curves are best cut on a bench pin or a similar notched support. To follow the line, turn the work, not the saw. Teeth must point downward

cheek with horizontal strokes. Figure 3 illustrates these steps, as well as faulty and correctly fitted tenons.

To cut the shoulders, hold the work in the vise or on bench hooks. Start sawing at the far edge, and level off the cut until the waste block is cleanly severed. This method prevents weakening the tenon by accidentally cutting too deeply, as might occur if the shoulders were sawed before the cheeks.

#### What saws are used in cutting curves?

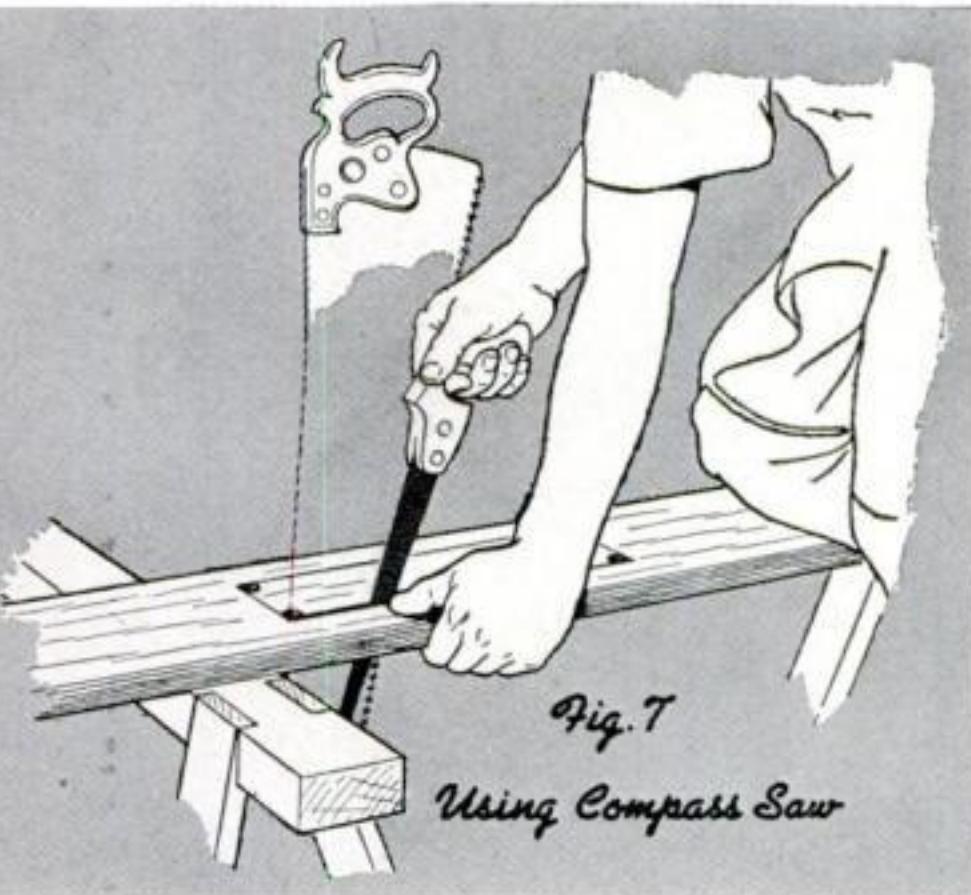
**G**RADUAL or "slow" curves can be sawed by springing the blade of a ripsaw or a crosscut saw around the arc. For smaller curves, use a compass, keyhole, or turning saw. These, as well as coping

saws, are shown in Fig. 5. The coping and bracket saws are for intricate curves and fretwork. One of the photographs illustrates how stock can be held in the bench vise for cutting with the keyhole saw, which is held in one or both hands and used with a horizontal stroke. Beveled cuts are made by slanting the blade. Saw outside the line in order to leave stock for smoothing the cut with a file or spokeshave.

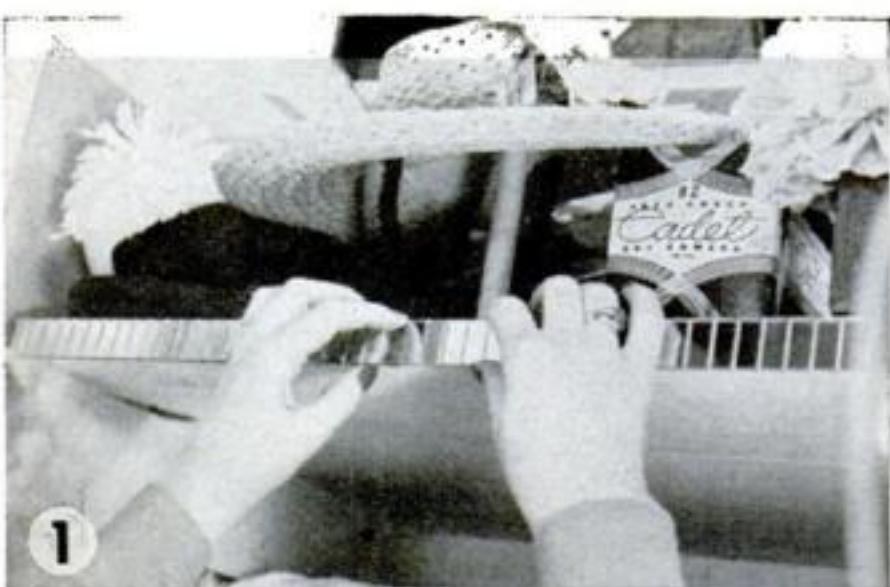
The coping saw is held with one or both hands, or, if the work is clamped in a vise, one hand may grasp the forward end of the frame, and the blade may be reversed so that the teeth point away from you (Fig. 6). Thin stock, however, should be supported on what is known as a bench pin, or else on a block that has a V-shaped notch cut in it. This support may be clamped in the vise or to the bench top, as shown in one of the photographs. The teeth of the saw blade must point downward, and the blade should be kept at right angles to the surface of the work. In following the pattern, it is best to turn the wood and not the saw. Inside cuts are made by threading the blade through a hole. Such holes should also be drilled wherever necessary to avoid having to make excessively sharp turns.

Figure 7 shows how a compass saw is used to cut a drawer opening in the apron of a table. The narrow blade is inserted through holes bored for the purpose. When a sufficiently long kerf has been sawed out, the ripsaw can be used instead for faster cutting. The shorter cuts across the width of the opening must, of course, be made with the compass saw alone.

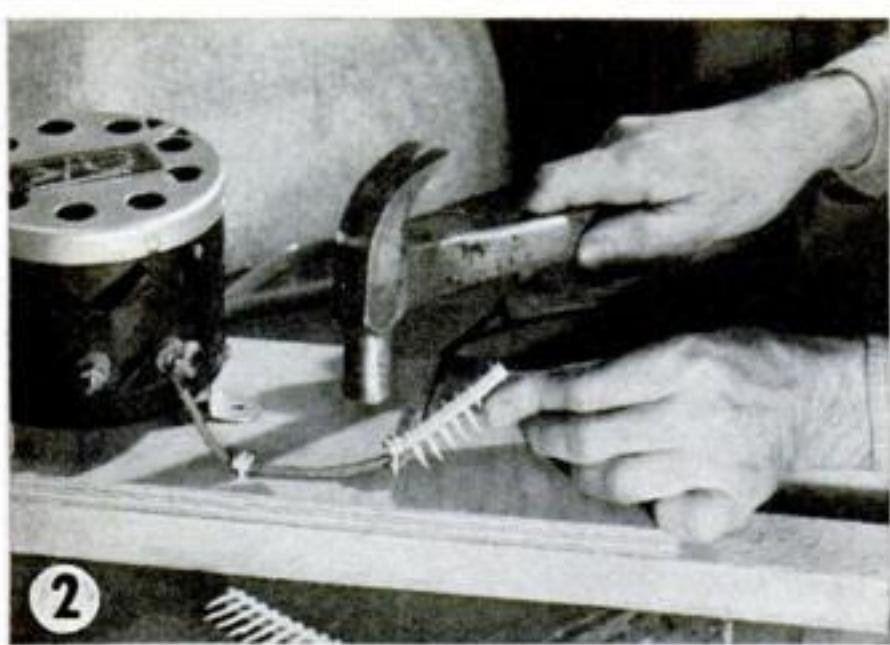
The dovetail saw is for light cutting and delicate work. It is held in one hand. Model makers find it particularly useful.



# New Appliances



TINY GLASS MIRRORS in adhesive-backed strips are for use as edging on closet or other shelves, or as general wood trim. The strips are flexible, may be applied to curved or straight edges, and can be bent around sharp corners. They are made in three designs each of crystal, blue, and gold



INSULATED STAPLES used in fastening electric wire are handy when obtained in strips. The end staple is bent back for driving, the rest forming a convenient handle. When in place, a twist will detach it. Colors are available to match wiring



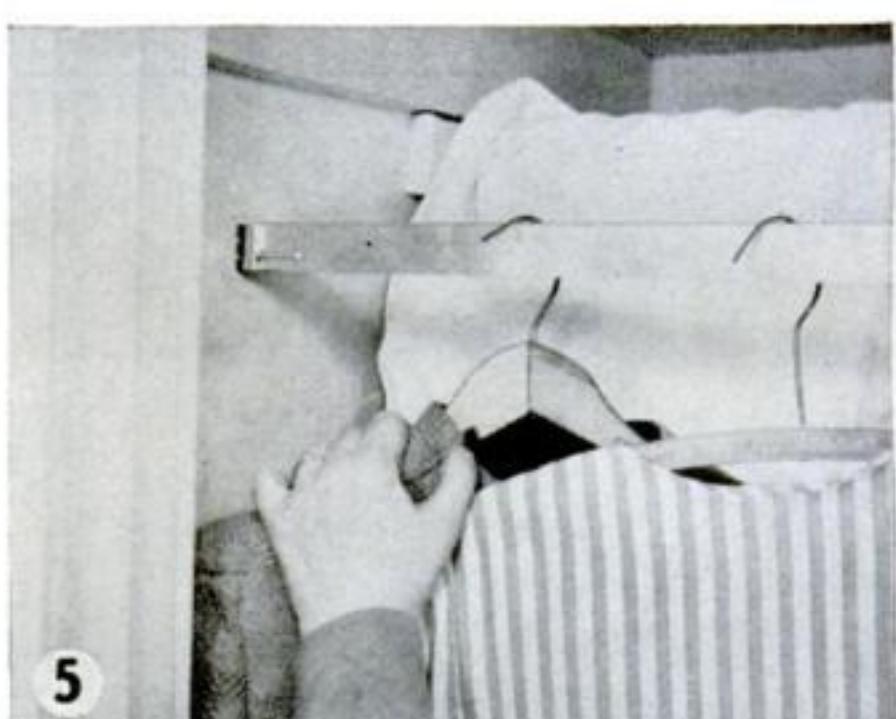
CANS THAT HEAT THEMSELVES add to the joys of picnics. The cans are double, with a chemical between the walls that heats on contact with air. Turn a can over, punch four holes, and let stand about fifteen minutes. The result will be piping hot, ready-to-serve spaghetti, beans, or coffee



ACCURATE KITCHEN SCALES, modern in design and enameled in white and a bright color to match canister sets, will weigh up to 25 lb., marked in ounces on a revolving dial. Steel springs are arranged to prevent stretching beyond their limit

5

ADJUSTABLE TO FIT THE CLOSET, these rods are supported by pressure on rubber end pads, and require no nails, screws, or brackets to put up. Of rustproof steel, they may be used for shoes, clothing, shelves, window or shower curtains, or towels. They are strong enough to hold 100 lb.



# for the Household

6

EQUIPPED WITH A HEADLIGHT, this electric iron guides the way around buttons and difficult spots. It has a steam attachment which clamps to the side of the board and connects with the iron through a hose; also a spring-clip arrangement to keep the cord raised and away from heat, and a control for selecting temperature for 15 fabrics. A glow light winks when the right heat is reached

7

WINDOW PRIVACY IS INSURED, glare shut out, and the dust nuisance minimized by this new shield. Steel bending bars, passed through top and bottom hem of curtain material, slide in or out of four sockets attached permanently to the window frame

8

SELF-SHARPENING, this paring knife is a new and handy gadget for the kitchen. When the blade dulls, a simple pull and push on the shaft renews the cutting edge. This may be done in the midst of peeling vegetables without bothering to rinse or wipe off the knife. A spring-steel device in the plastic handle does the honing, and grips for thumb and finger reduce the possibility of slips

9

FOR CLEANING VENETIAN BLINDS, a complete kit is now available. It consists of a cleaning fluid, a lamb's-wool polishing glove, and a bottle of fabric cleaner for use on the tapes and cords. The special cleaning fluid leaves a hard, smooth, protective coating on the slats, and is applied simply with a cloth or natural sponge. Once dry, it is rubbed briskly with the lamb's-wool glove to bring out the luster. The design of the glove is such that the top of a slat and the bottom of the one just above it can be polished in one operation



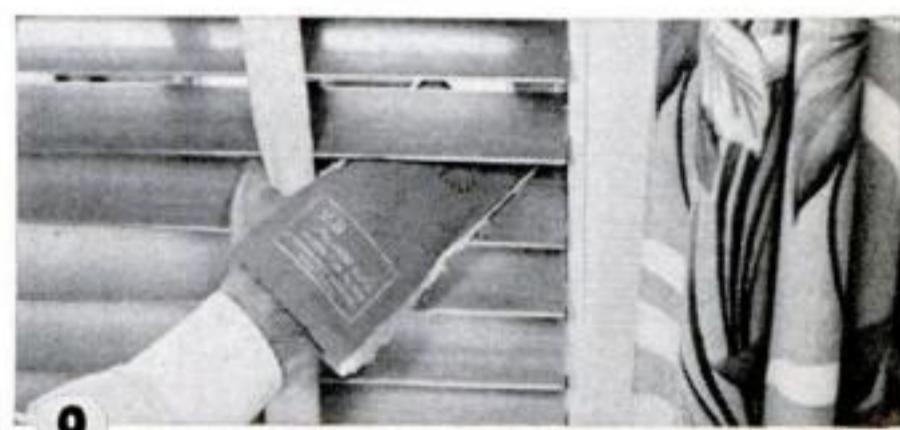
6



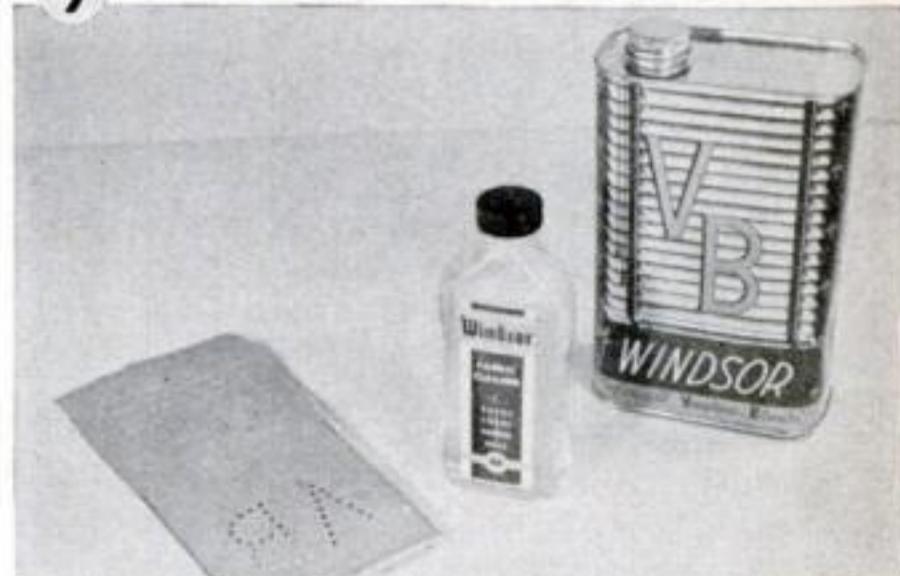
7



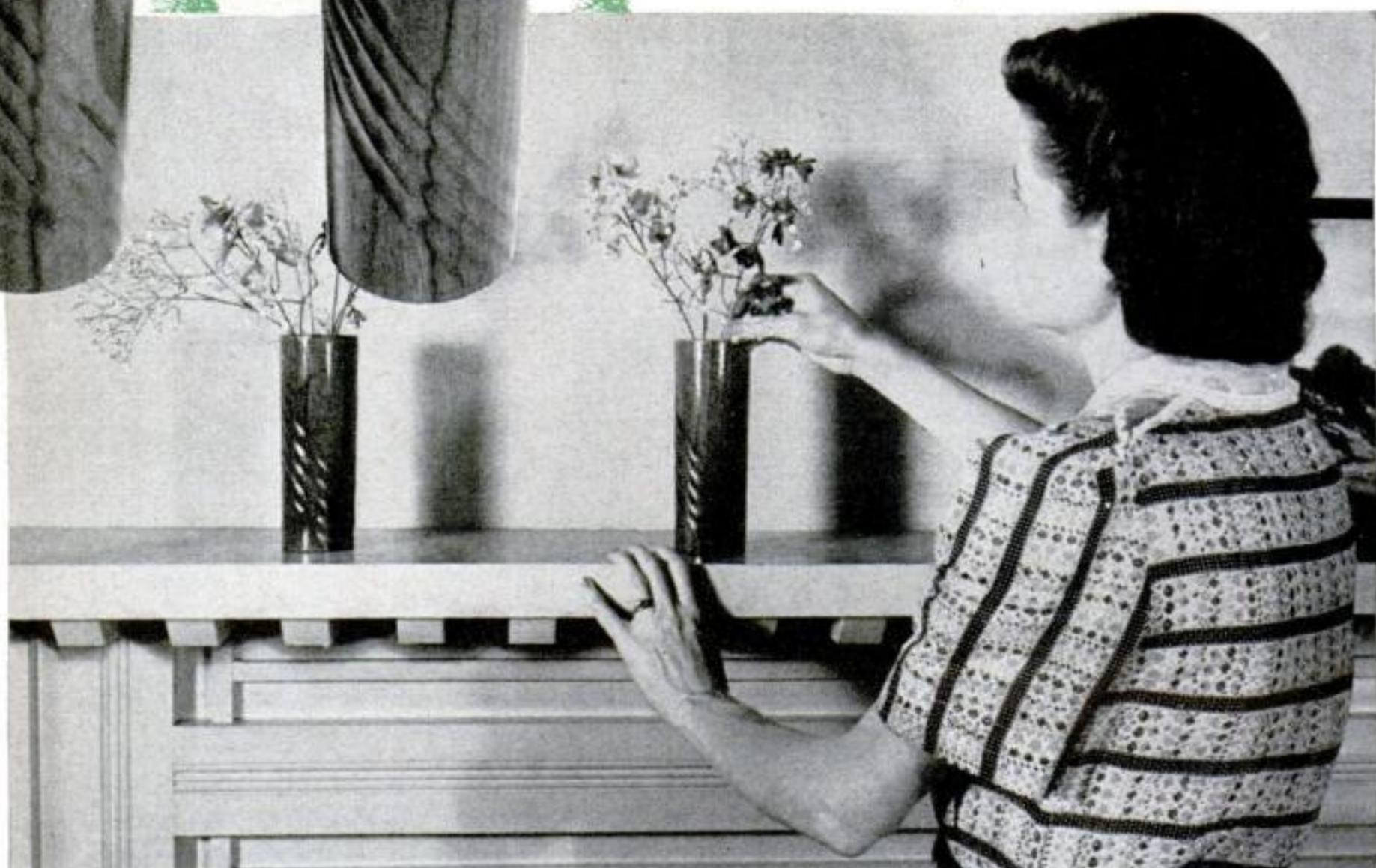
8



9



Craftwork articles such as these fluted vases make beautiful and distinctive Christmas gifts, often of a kind that could not be bought on the open market. The vases shown have water-tight inner containers



# Spirally Fluted Wooden Vases

## HERE'S A NEW TRICK FOR WOOD TURNERS . . .

**I**F YOU are looking for a lathe project a little out of the ordinary, try making these wooden vases with their decorative flutings. For each vase turn a piece of walnut or other hardwood  $7\frac{1}{4}$ " long with a diameter of  $2\frac{5}{8}$ " at one end and  $2\frac{3}{8}$ " at the other. Sand the turnings smooth.

From 24-gauge sheet metal, cut and bend a guide to be used in the spiral fluting. This is screwed to the ends of each vase turning as illustrated in one of the photographs. A hardwood stick 12" long and 1" in diameter is turned smooth and around it a strip of sandpaper is glued to form a sanding drum. Run the lathe at its highest speed, and hold the block against the drum, following the metal guide as you rotate the piece. When one flute is finished, set the guide over for the next flute. It is a good idea to make tests on waste stock to determine the

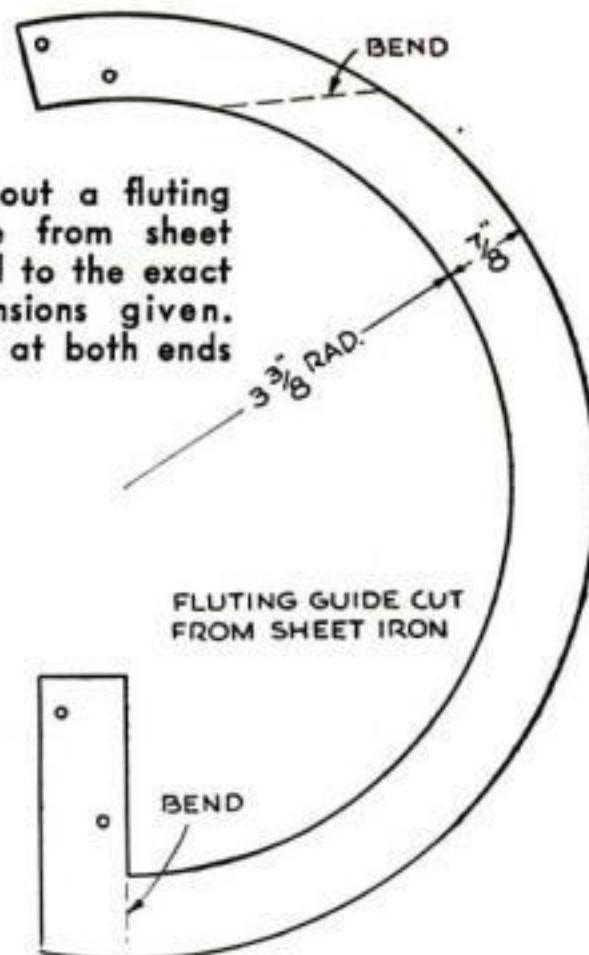
proper guide settings. Continue until the desired number of flutes have been made.

Now mount the turning by its large end on a faceplate and turn it out to an inside diameter of  $1\frac{5}{8}$ " for half its length. From  $\frac{3}{4}$ " stock turn a bottom plug and glue it into a turned recess as shown.

When the glue is dry, mount the turning on the faceplate by the bottom and turn out the upper part also to  $1\frac{5}{8}$ " diameter.

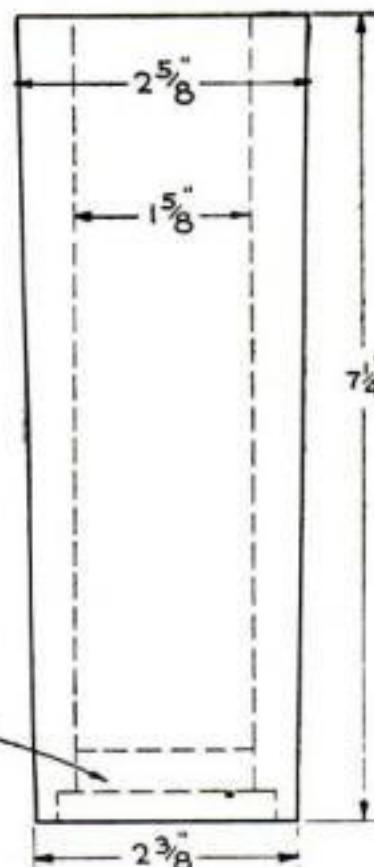
Finish each vase with three coats of shellac, rubbing down the surface between coats with fine steel wool. Glue felt or blotting paper on the bottom of each vase.

Water-tight containers for the vases illustrated were made from old brass tubing obtained from a plumbing shop. These measure  $1\frac{1}{2}$ " in diameter by  $6\frac{1}{4}$ " in length, and are closed with metal disks soldered to the bottoms.—BENJAMIN NIELSEN.

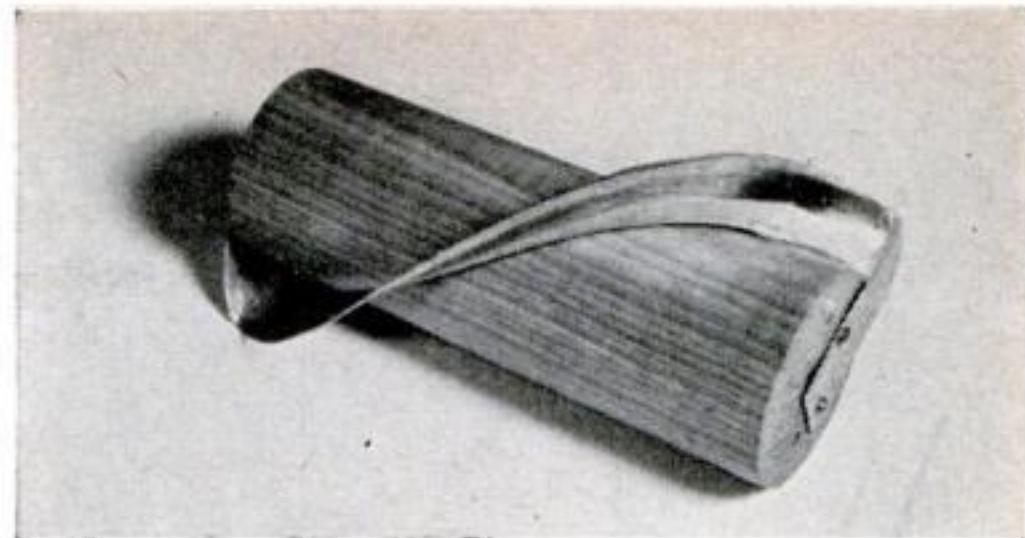


Cut out a fluting guide from sheet metal to the exact dimensions given. Bend at both ends

Turnings taper on the outside, but are straight inside. Recess one end for the plug



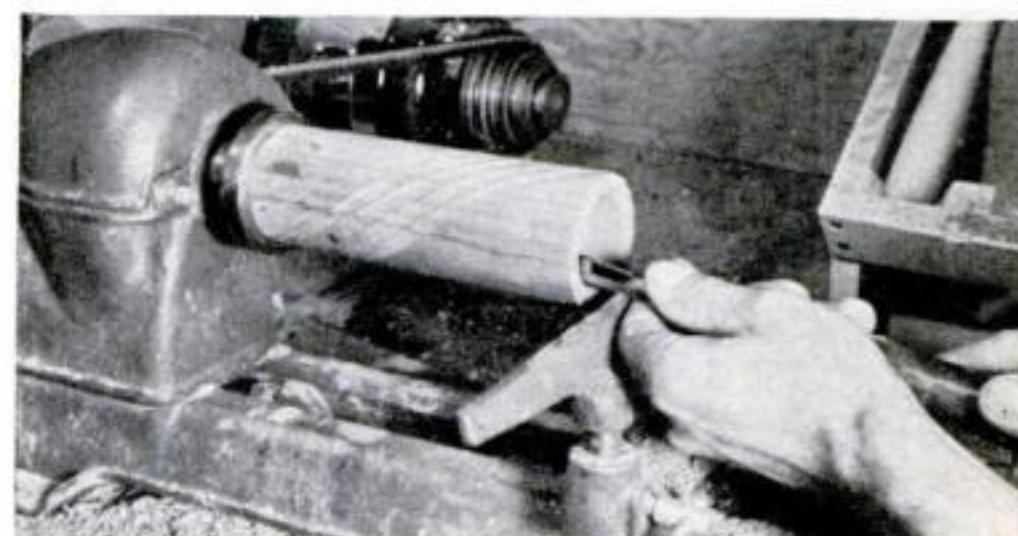
Water-tight inner containers can be made by soldering metal disks into the ends of 6 1/4" lengths of brass pipe. Pieces from a plumber's scrap pile will serve the purpose



The fluting guide, carefully and smoothly bent to shape, is attached to each of the solid turnings as above. Fluting should first be attempted on scrap



Holding the guide gently against the sanding drum, turn the piece evenly to form a spiral groove of uniform depth. Reset guide for successive flutes



When fluting is completed, fasten the work by the large end to a faceplate and turn out the inside halfway, as well as the recess for the bottom plug



Glue the plug in place, allow to set firmly, then remount the work to turn out the remaining part. A simple rubbed shellac finish completes the pieces



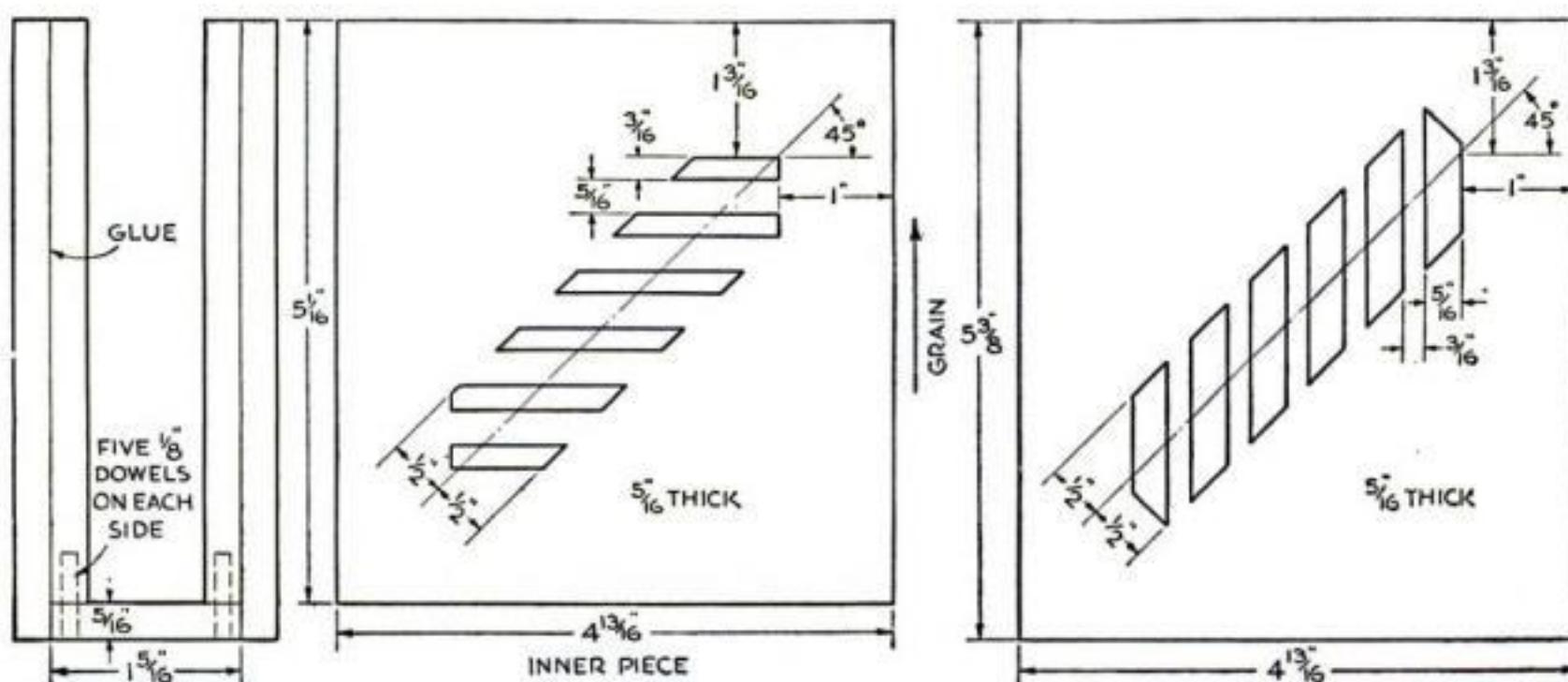
## Napkin Holder Displays Curious Lattice Effect

SMALL pieces of nicely grained wood can be used to advantage in making this distinctly different napkin holder. If a band saw is available, the two panel patterns may be laid out on  $\frac{5}{8}$ " stock, jigsawed, and split on the band saw to make four pieces  $\frac{1}{4}$ " thick. Alternatively, two pieces of  $\frac{1}{4}$ " stock can be glued together, with paper between the joint, and separated after the inside cuts have been made. Cut the inner pieces slightly oversize to allow for trimming them accurately to shape after they have been glued to the outer ones.

Glue up the parts as shown, and attach them to a base by means of  $\frac{1}{8}$ " dowels pinned into the inner panels. Finish with two or three coats of thin shellac, rubbed down with very fine abrasive paper, and wax. Approximate time, 3 hours.



Outer panels are chosen for best grain

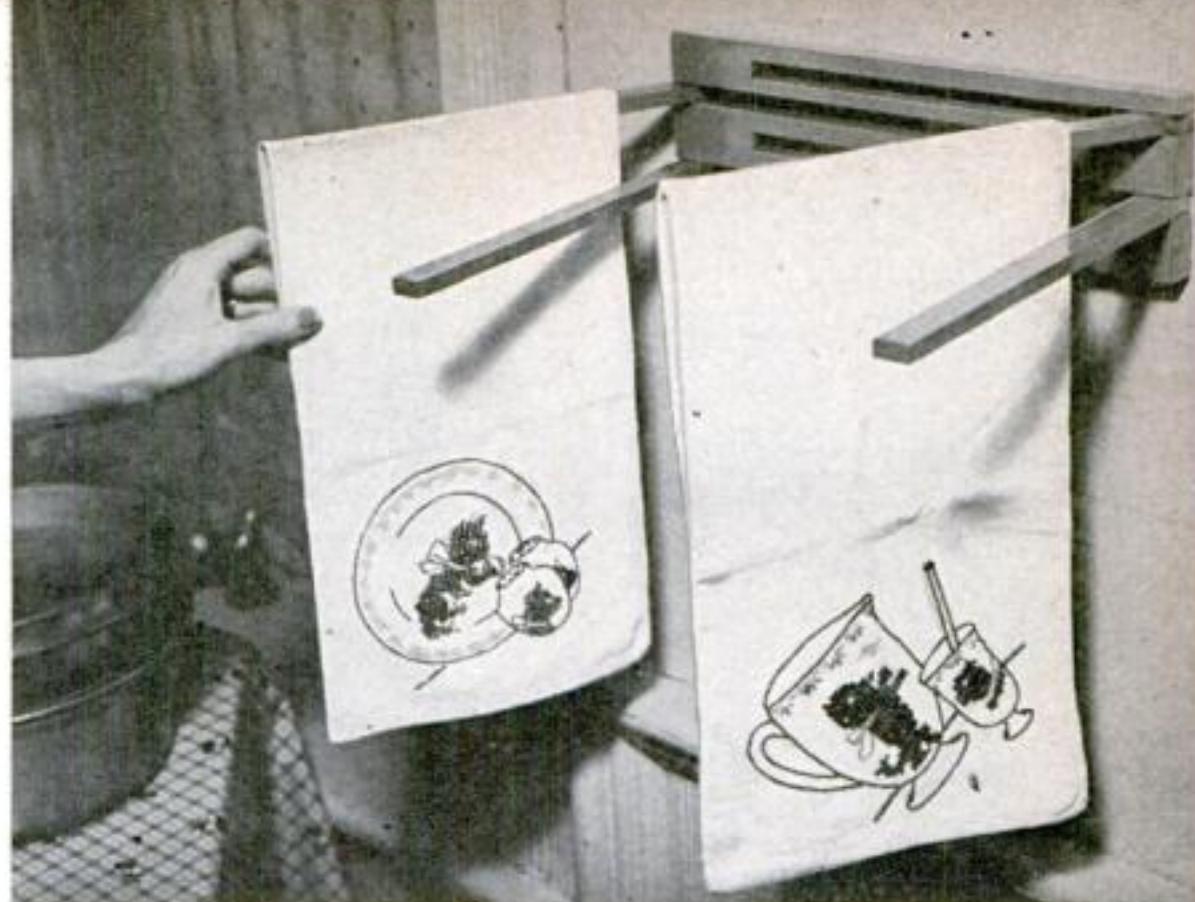


## Folding Towel Rack Sawed from One Piece of Wood

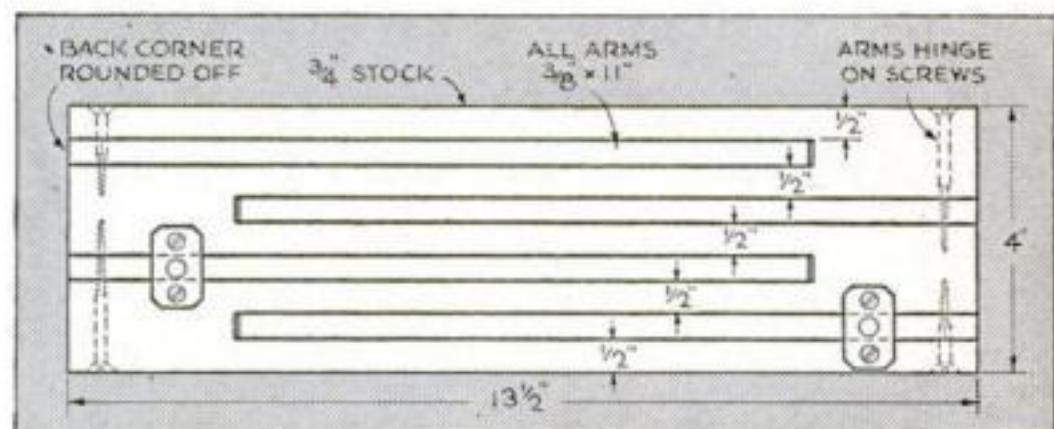
ONE piece of wood is all you need to make this novel folding towel rack, which takes scarcely any room when not in use. Rip the stock as indicated in the diagram at the right, using a circular saw, if possible, and keeping the same side down so that the short superfluous kerfs due to the curvature of the blade will all be at the back of the finished piece. The short transverse cuts can be made on a band saw, a scroll saw, or with a hand coping saw. Round the back corners of all four arms so that they will clear the wall and swing out freely. Replace them in the back, and drill holes for wood screws or a  $\frac{1}{8}$ " metal pin through both arms and back at the same time in order to insure perfect alignment.

Two flat metal plates are screwed on from the back as shown in the drawing, and the covering arms swung aside in order to insert screws for mounting the rack on the wall.

The towel rack can be finished in colored enamel to match any kitchen or bathroom color scheme. The approximate working time is  $1\frac{1}{2}$  hours.

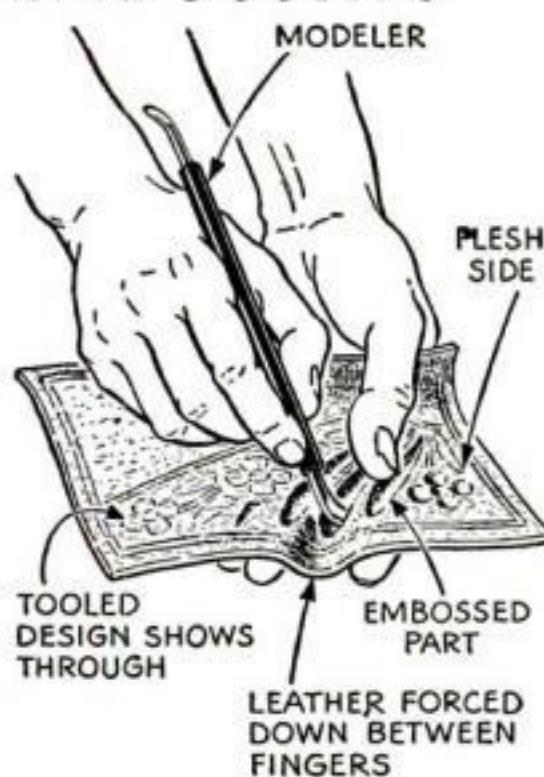


Smoothly working arms swing out from the rack to hold kitchen towels. When not in use, they fit back flat in the slots



Pattern for sawing arms and back from one piece of stock, and illustrating the method of attaching wall screw plates

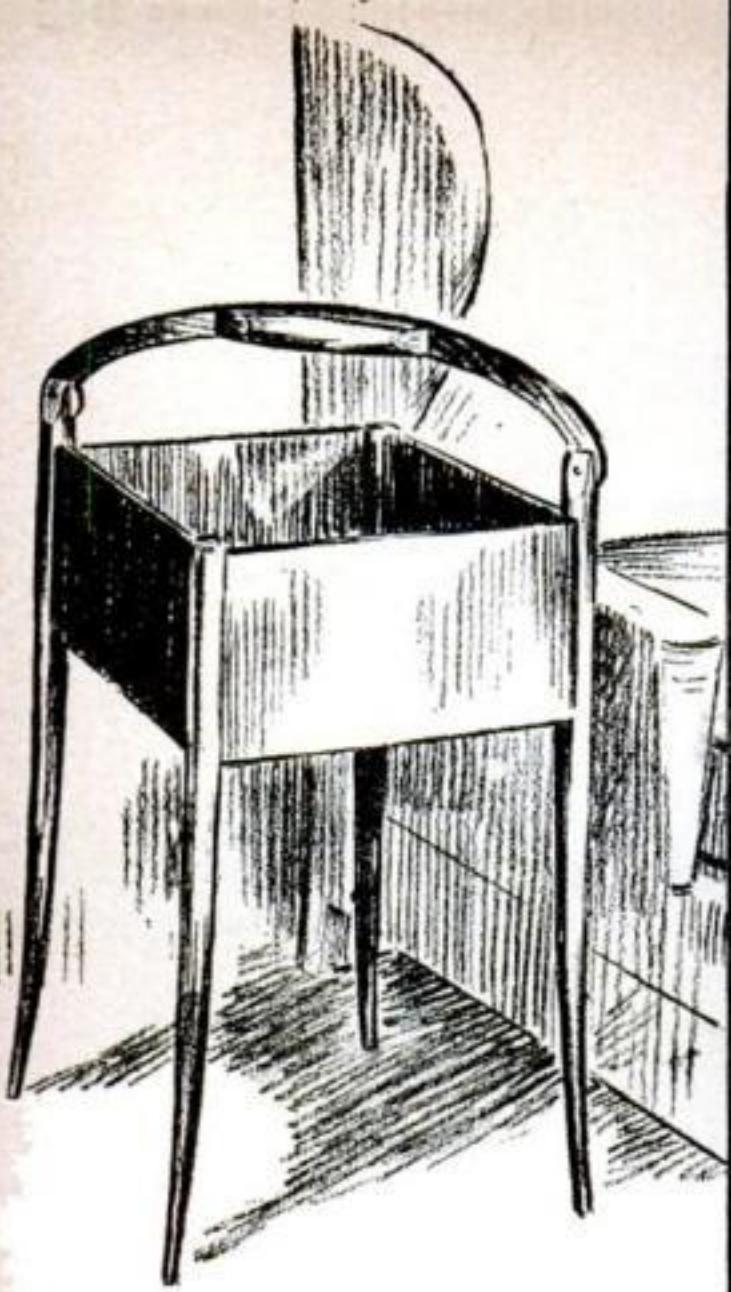
### EMBOSSING



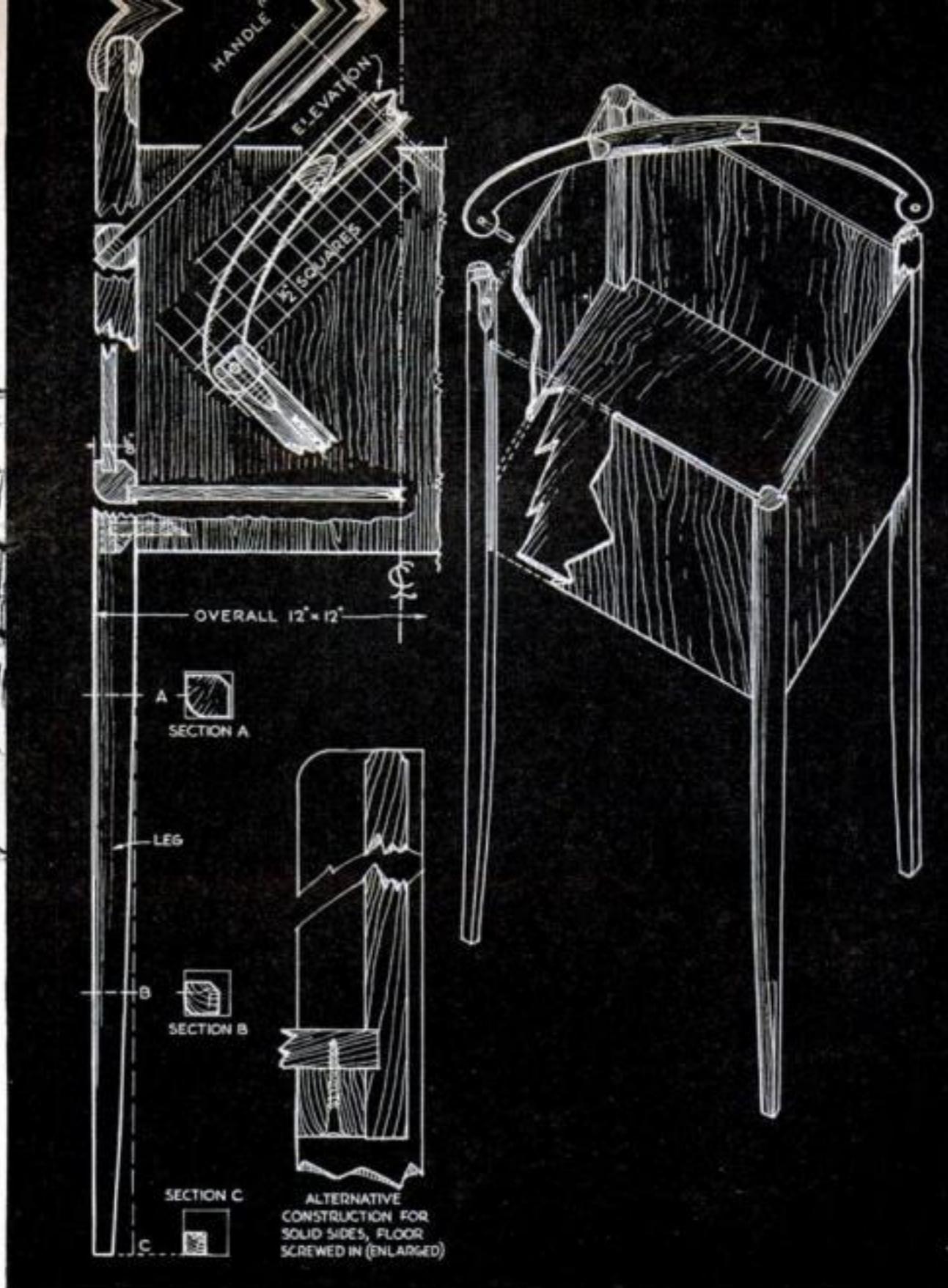
### [ LEATHER CRAFT—6 ]

Embossing produces designs that are raised above the original leather surface.

Make the design and shade all parts to be embossed. Transfer design to leather and tool it (Leather Craft—4). This should produce a clear outline of the design on the flesh side. Hold leather with flesh side up and force leather to be embossed down between fingers, using broad end of modeler or ball point. Then place flesh side of leather on marble and put down leather around embossed parts. Repeat these operations until leather is raised to desired height. Do not over-emboss. Large embossed parts should be backed with a mixture of flour, kapok, and water. Keep this filling level with background. Turn leather over and lightly outline design and all lines in embossed parts. After leather dries, cement lining over kapok backing.



Careful beveling and tapering of the inner faces of the legs on the knitting box above, and rounded outer corners, result in a delicate, graceful flare



# Two Knitting Boxes... TIMELY GIFTS FOR RED CROSS WORKERS

BY JOSEPH ARONSON

Author of *The Encyclopedia of Furniture*

Now that knitting has become an almost universal pastime among women, why not put one or both of these attractive knitting boxes on your craftwork gift list? Either one will hold a good-sized piece of work and plenty of the "makings," yet remain light enough to be carried easily from room to room.

As all dimensions have been held to a minimum, the joints must be carefully made. The legs of the first box, which are cut from  $\frac{7}{8}$ " square stock, are rounded on the outer corner to within 3" of the bottom ends. Taper the inner faces of each leg, with a slight curve, starting from a point

12" up, to bring the cross section at the foot down to one fourth the original square. Then bevel the inside corner from a height of 13" to within 3" of the foot. Careful work with plane and sandpaper will produce the delicately flared leg so characteristic of good English and French designs.

A molded upper edge on the sides, which will leave only the core to show long grain, will stain nicely. The molding should, however, stop short of the ends, leaving square edges to fill the  $\frac{1}{4}$ " deep dadoes in the legs. Glue in the sides with the outer grain vertical. The floor also is dadoed into the sides with  $\frac{1}{8}$ " sinkage, and braced with small glue blocks. If solid stock is used for the sides, do not glue in the floor, but screw it to cleats in turn glued to the sides, as shown in the large detail, to allow for shrinkage.

Shape and slot the diagonally opposite longer legs for the handle rail, which is pinned with tightly fitted  $\frac{1}{4}$ " dowels. Shape the handle grips and glue them on.

The second box shown has a hopperlike body that calls for precise cutting of its spline-mitered corners and the angular rabbet into which the floor is set. The upper edge of each side curves down at the ends. Turn the handle shaft with a dowel tenon at top and bottom. Leave the lower shaft square, and fasten it to the floor plate with wood screws.

Taper the band-sawed legs in thickness from top to bottom. Pin them to the shaft with dowels passing through the latter. Glue the handle shaft in place through the floor and floor plate, and for additional strength insert a 1" wood screw through the dowel joint as shown. Other wood screws inserted at an angle hold floor and plate together.

The handle must be shaped by hand. Glue it to the upper tenon. Soften all sharp edges by careful sanding. If nicely grained

## LIST OF MATERIALS

### BOX No. 1

No.	Pc.	Description	T.	W.	L.
2	Legs		$\frac{7}{8}$	$\frac{7}{8}$	22
2	Legs		$\frac{7}{8}$	$\frac{7}{8}$	24
4	Sides (plywood)		$\frac{1}{4}$	8	$10\frac{3}{4}$
1	Floor (plywood)		$\frac{1}{4}$	$11\frac{1}{2}$	$11\frac{1}{2}$
1	Handle rail (plywood)		$\frac{1}{4}$	$2\frac{1}{2}$	$17\frac{1}{4}$
2	Handle grips		$\frac{3}{8}$	$\frac{7}{8}$	$4\frac{1}{4}$

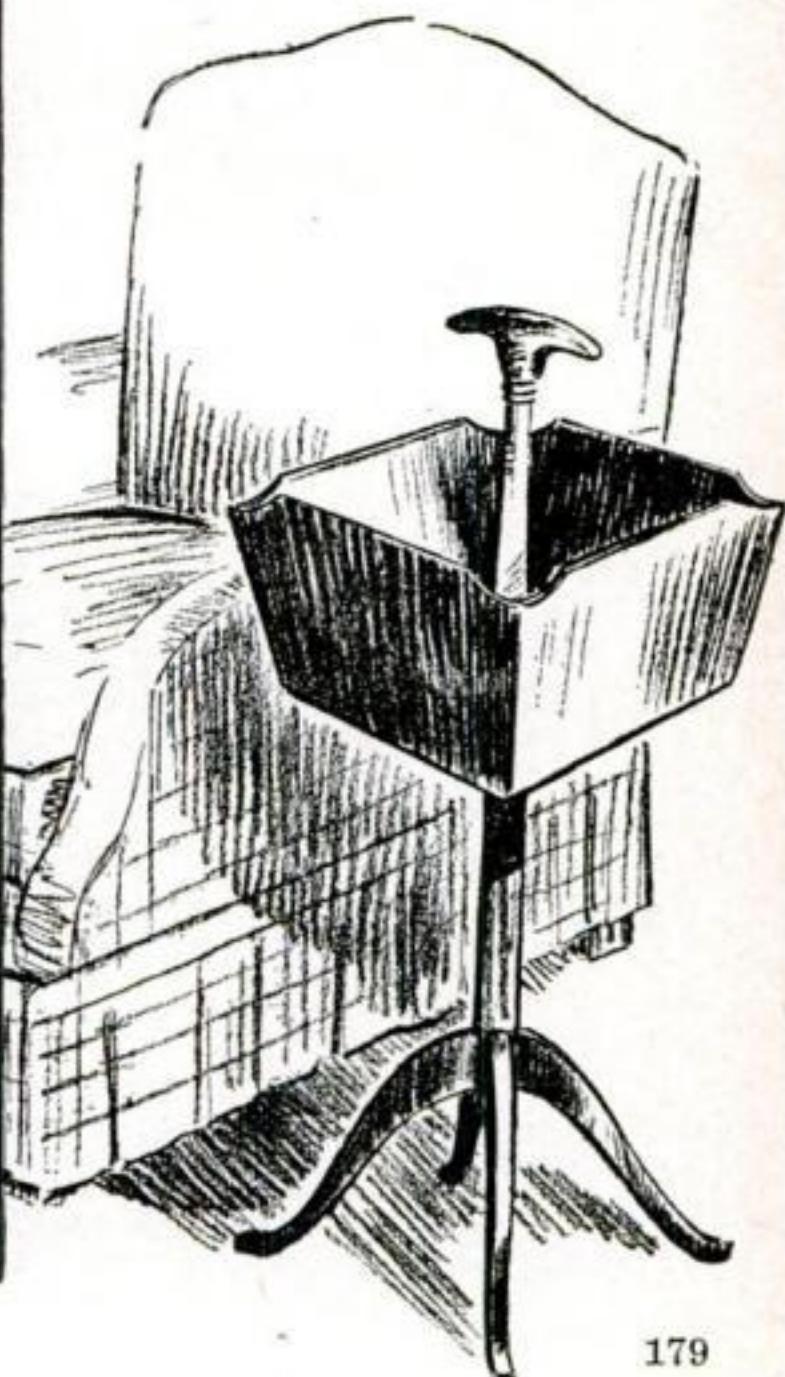
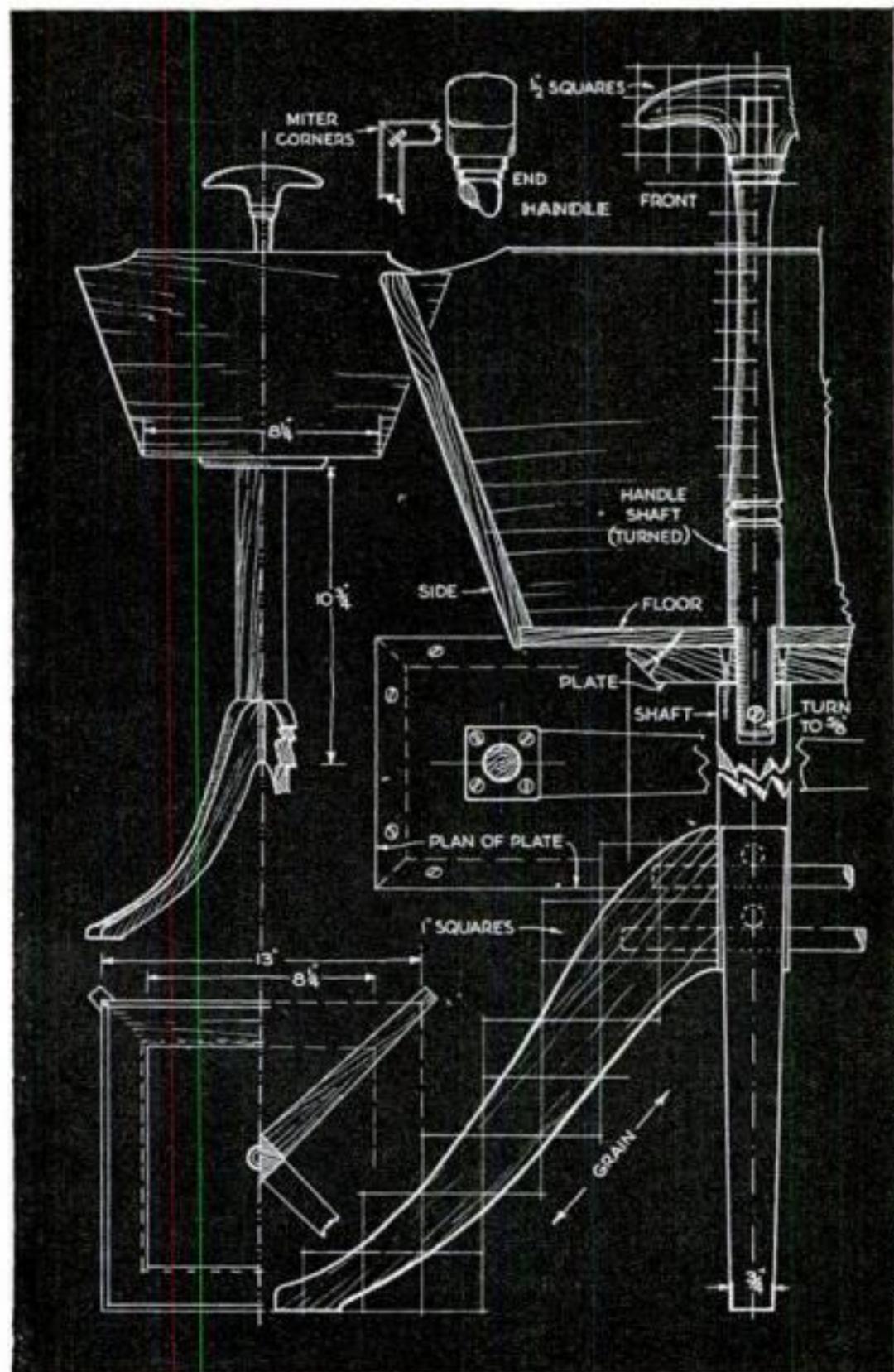
### BOX No. 2

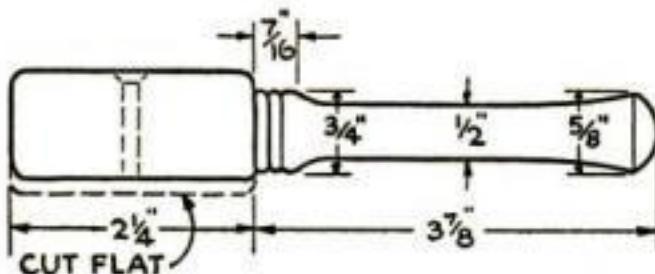
1	Shaft (square)	$1\frac{1}{4}$	$1\frac{1}{4}$	$10\frac{3}{4}$
1	Handle shaft (turned)	$\frac{7}{8}$		11
4	Feet	$1\frac{1}{16}$	$2\frac{1}{4}$	11
4	Sides	$\frac{3}{8}$	$7\frac{1}{4}$	13
1	Floor (plywood)	$\frac{1}{4}$	8	8
1	Plate (plywood)	$\frac{3}{4}$	$4\frac{1}{4}$	$4\frac{1}{4}$
1	Handle	$1\frac{1}{8}$	$1\frac{3}{8}$	4

Note: All dimensions are given in inches and are finished sizes.

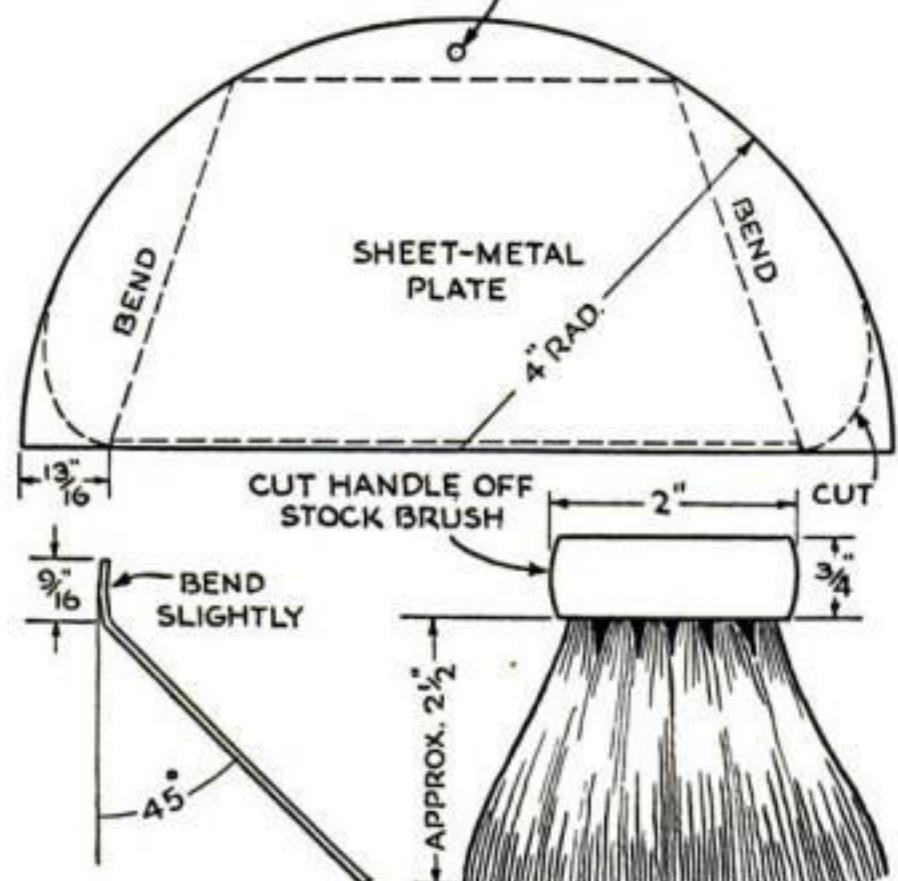
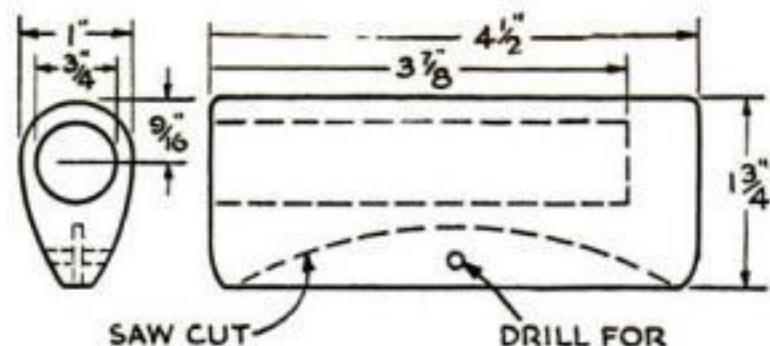
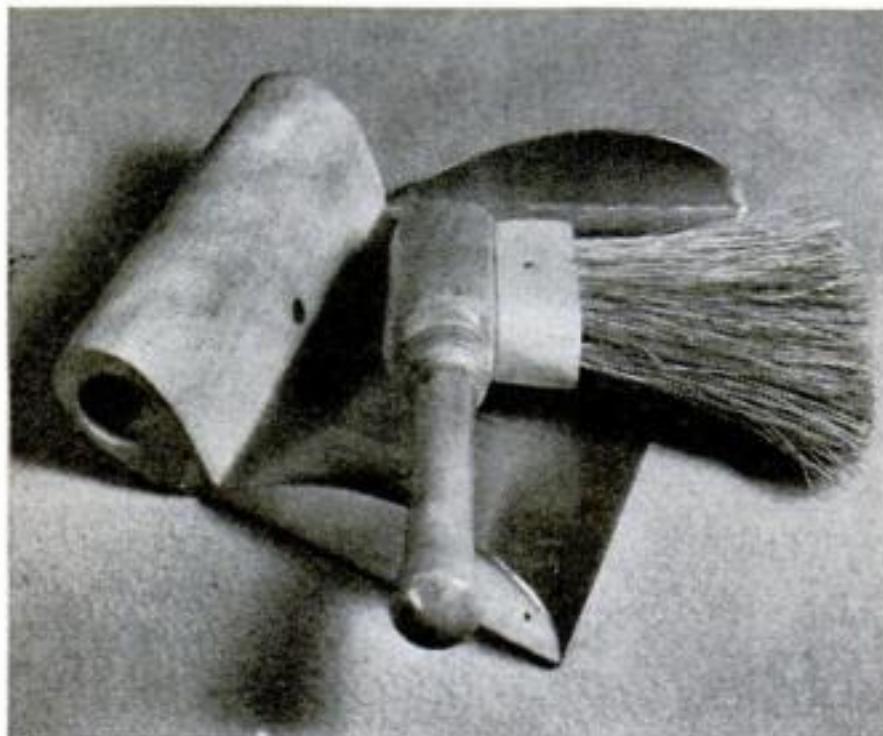
wood is used; it should be finished with stain and shellac or varnish, rubbed to a satin luster, to take advantage of the natural beauty of the grain. Plywood may, if preferred, be finished in colored lacquer or enamel.

Precise cutting of the spline-mitered corners and angular rabbet into which the floor fits is necessary to construct the hopperlike body of the box below





Metal and a richly grained wood make this table tidier a welcome gift for Christmas. It can be turned out at home in the course of an evening



## Distinctive Craftwork



PREPARED ESPECIALLY FOR POPULAR SCIENCE  
ERNEST R. DEWALT, INDUSTRIAL DESIGNER AND

THIS Christmas, why not give something nobody else can—your own craftwork? Now is the time to begin making gift articles. The two shown on these pages are practical, useful, and distinctive in design.

**TABLE TIDIER.** Here is something to please the lady of the house. The article shown was made of primavera, a beautifully grained, straw-colored South American wood, and sheet copper, but other combinations may be used.

To make the handle, drill a  $\frac{3}{4}$ " hole lengthwise  $3\frac{7}{8}$ " deep in a block of wood 1" by  $1\frac{3}{4}$ " by  $4\frac{1}{2}$ ". Hold the block against a stop on the circular-saw table, and carefully lower it against the blade to form the semicircular groove for the shovel blade. Then plane or sand the wood to shape.

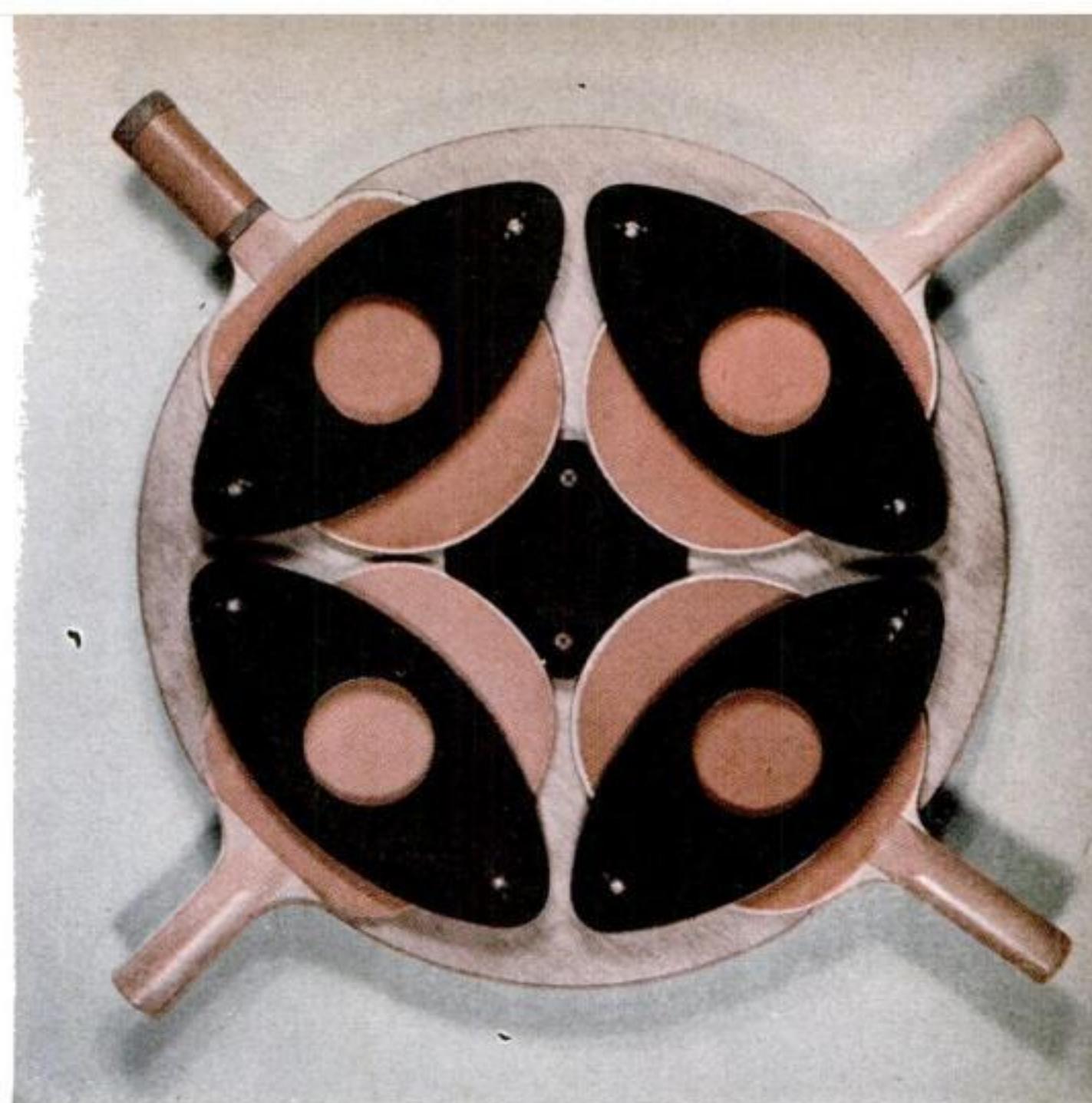
Cut a semicircle of  $1/32$ " thick metal, trimming the two corners as shown. Bend up the edge on three sides, and bend the

middle flange slightly so that it will wedge firmly in the slot. Clean the metal thoroughly with steel wool and fine abrasive paper; then apply a coat of clear lacquer to prevent tarnishing. Fasten the blade in the handle with one or two metal rivets.

A soft fiber brush is purchased, the handle cut off, and another turned and fitted as shown. Make the shoulder a press fit in the shovel handle, and fasten to the brush with a single countersunk screw.

Finish the wooden parts with two coats of clear lacquer or varnish. Approximate time,  $2\frac{1}{2}$  hours.

**TABLE-TENNIS PADDLE PRESS.** Four paddles, each in its individual press, are accommodated in this unique game-room accessory. It is intended to be mounted on the wall and revolves freely for convenience in racking or removing the bats. Initials, a club insignia, or a decalcomania can be applied to the piece in the center.



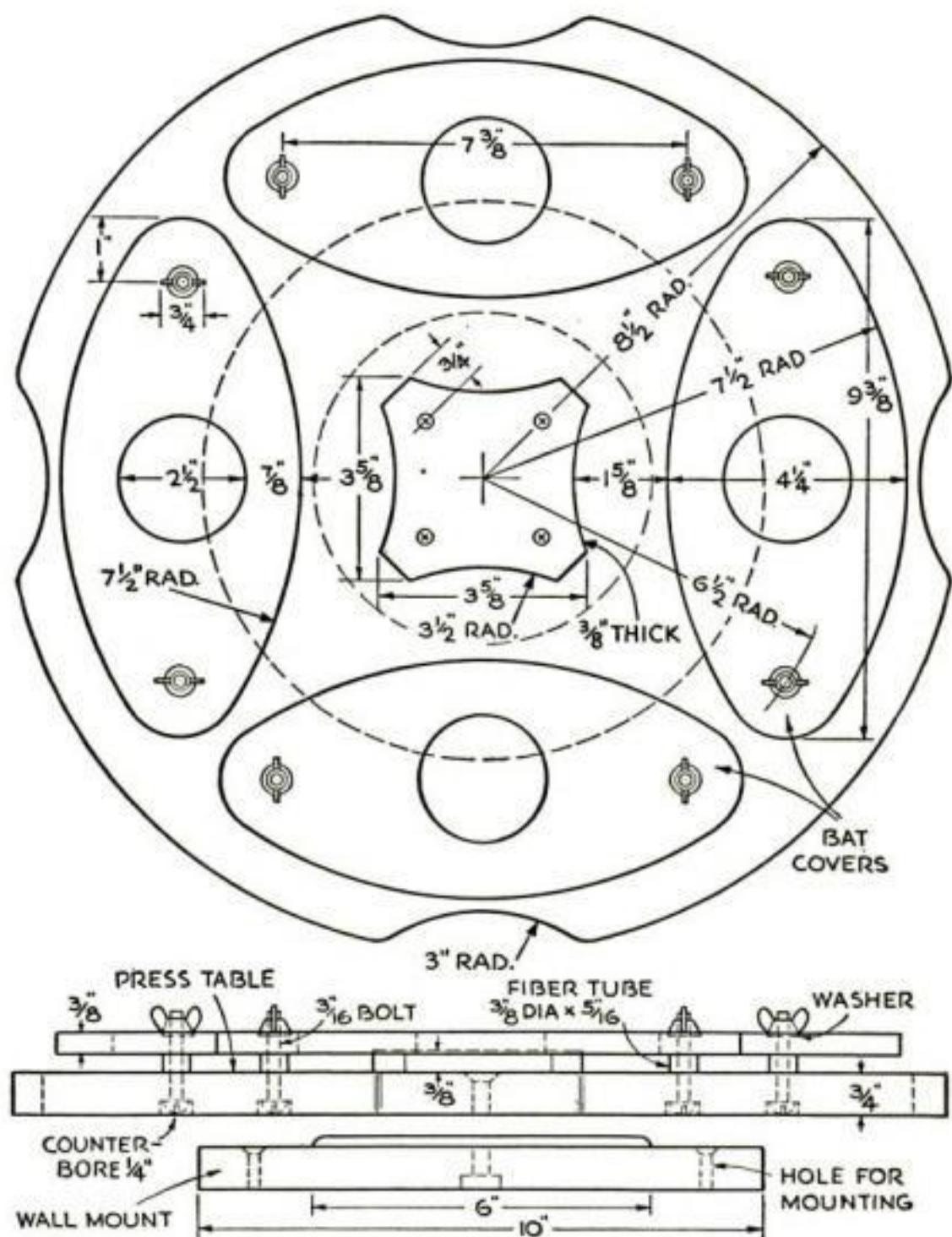
Distinctive is this press for holding an entire set of four table-tennis bats within convenient reach on the wall of the game room. It is designed to revolve to make it easier to rack or take out the paddles. Its construction throughout is of plywood, and it may be finished in striking colors or in a simple modern manner. A detailed drawing, below, gives all dimensions for both the revolving table and the supporting disk.

# Projects

## READERS BY CRAFTSMAN

Plywood is used for all the parts. The wall mount is either turned or built up of two pieces to form the shoulder. The table is 17" in diameter, with four semicircular cut-outs to clear the bat handles. Space 3/16" by 1 5/8" clamping bolts on a 6 1/2" radius, and slip 5/16" lengths of fiber tubing or drilled dowel over them before mounting the press plates. These are cut from 3/8" plywood, as is the centerpiece. Use small washers under the wing nuts.

A simple modern finish is obtained by rubbing white paint into the wall mount and the table; when dry, apply two coats of white shellac. In the original, the press plates and centerpiece were finished with flat black paint. Approximate working time, 6 hours.



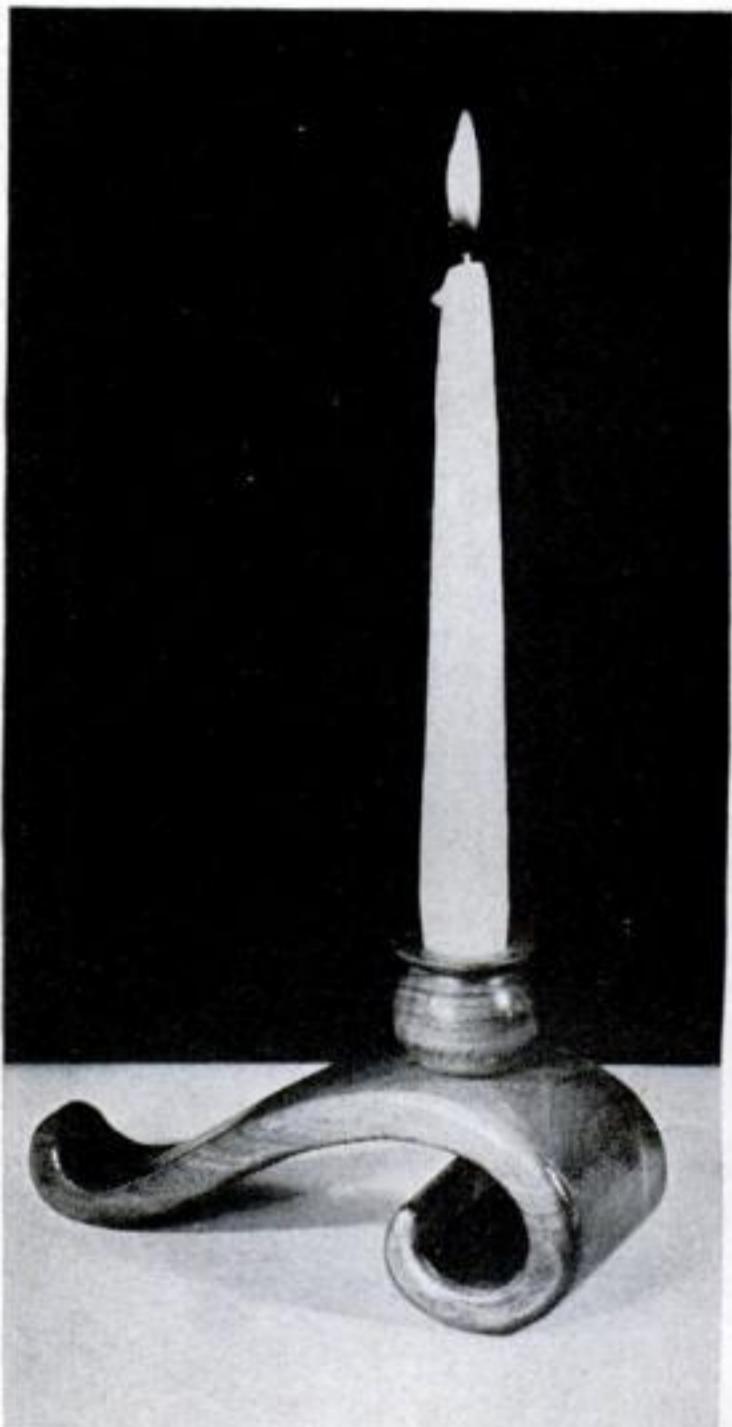
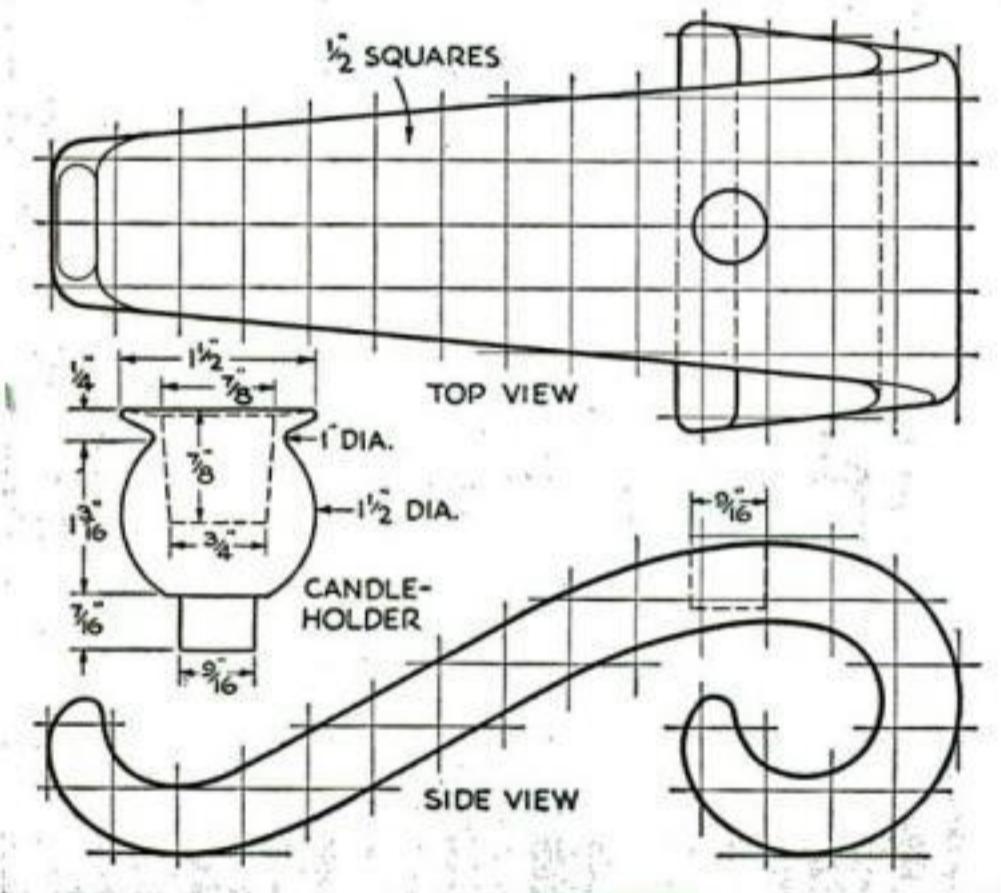


## Scroll Candleholders ARE UNUSUAL CRAFTWORK PROJECTS

A PAIR of graceful candleholders like the one illustrated will lend a charming touch to almost any decorating scheme. They can be band-sawed to shape from two blocks of walnut  $2\frac{1}{2}$ " by  $3\frac{1}{8}$ " by 7".

Transfer the side view by means of  $\frac{1}{2}$ " squares, saw out this profile, and carefully cut to the tapered form shown in the top view. Bore a  $9/16$ " hole at the uppermost point for a turned holder of the same material as the base.

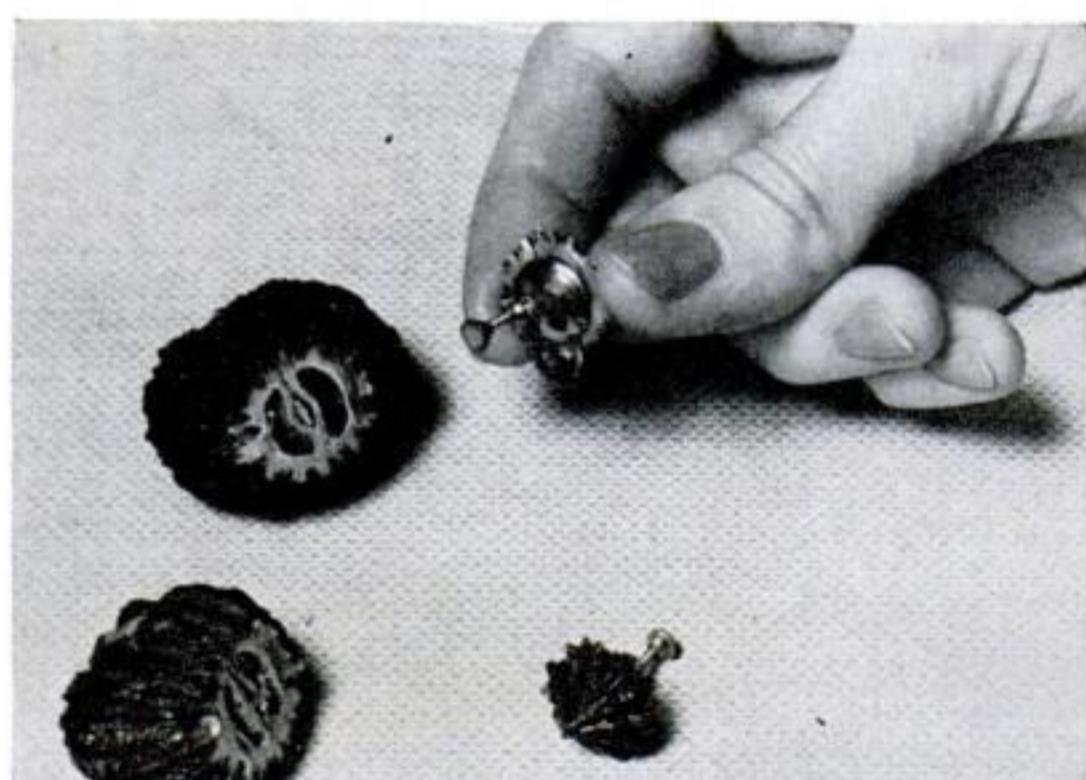
Round all corners and edges, sand smooth, and glue in the holder. Finish with stain, filler, and either varnish or shellac and wax, or in any preferred manner.—B. N.

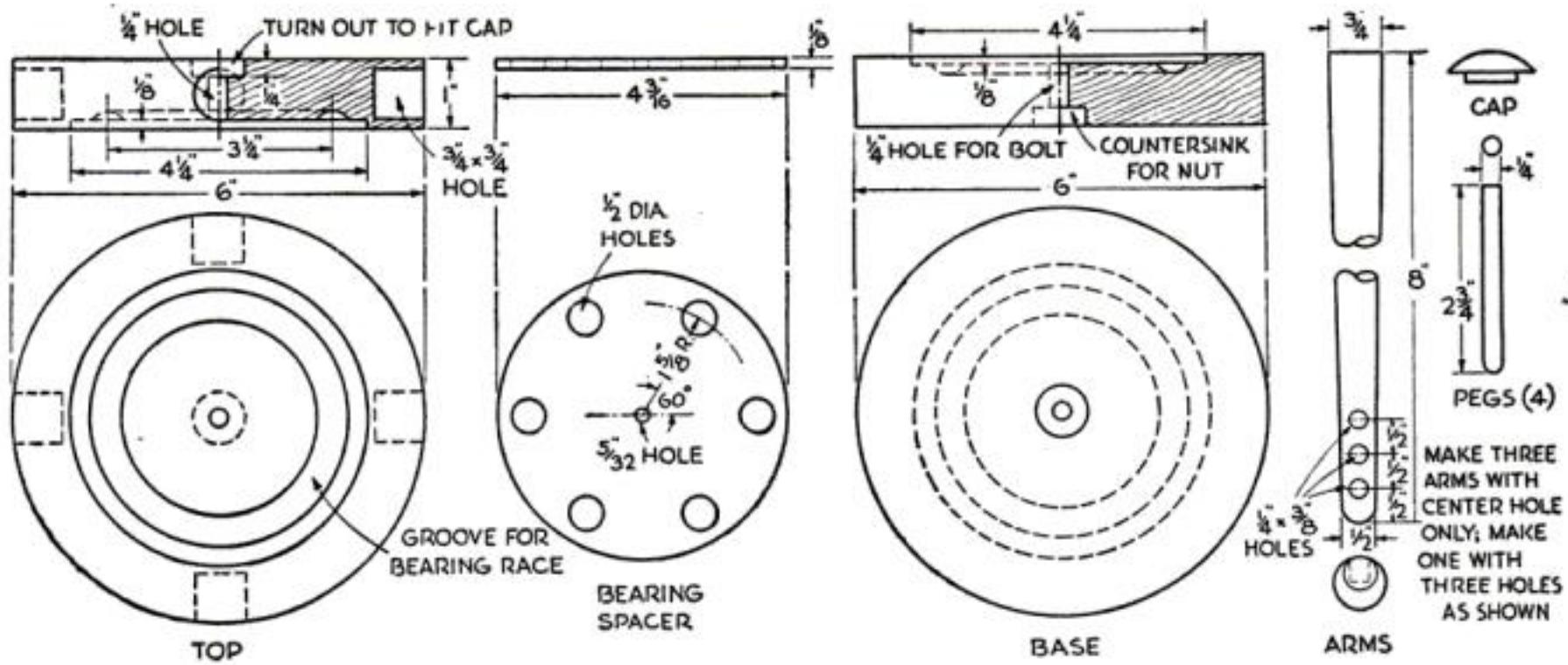


Walnut takes a desirable finish that sets off these candleholders well, but another wood might be used. Close-grained, sound pieces are essential to avoid danger of splitting across the short-grained portion

### Novel Ornaments for Earrings Cut from Black Walnuts

THESE attractive novelty earrings were made from the tips of black walnuts. The screw clips can be obtained from an old, discarded pair of earrings, or a new set can be bought at the ten-cent store and the ornaments removed from them with a knife or a small pair of pliers. The tip ends are first cut from two walnuts, and then are cleaned thoroughly with a small, stiff-bristled brush. Next, a coat of clear, quick-drying varnish is applied to the tips, and they are allowed to dry for a short while. They can then be fastened securely to the clips with any good liquid cement.





## For Knitters...

### A BALL-BEARING YARN REEL



**K**NITTERS and knitting everywhere! If ever there was a season dedicated to knitting, this winter is going to be one, so there could be no better time to make a

few knitting accessories in your home workshop. First, of course, comes a knitting box or stand of some sort, and two designs have been suggested in a preceding article (pages 178 and 179). Next in importance is a yarn reel to hold a skein of wool.

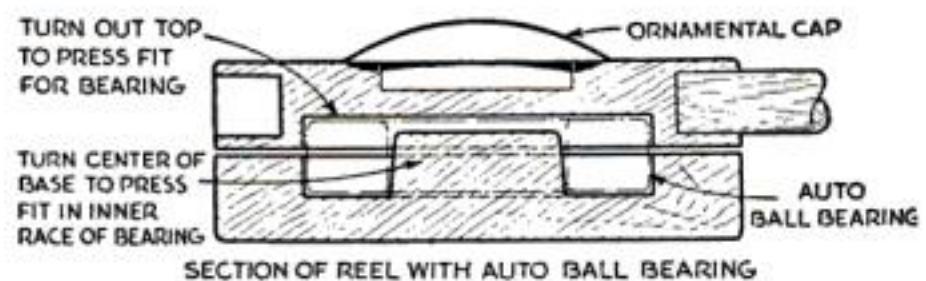
The primary purpose of a reel is to hold a skein while the yarn is being wound into a ball. If, however, a knitter works in one place and does not wish to carry her knitting around, she can save the time required for winding the yarn into a ball and draw it directly from the reel, but it is essential in this case that the reel be neatly made and nicely finished.

If a large discarded automobile ball bearing can be obtained, it is necessary only to turn two 6" disks to be a press fit inside and over the bearing respectively, as the lower drawing shows, and to fit the four arms and a decorative cap. A heavy bearing offers just the right resistance to the unwinding of the yarn.

Not as simple, but perhaps more novel, is the use of common glass marbles as bearing balls. Buy a bag of marbles and sort them to find six of exactly the same size. Turn the top and base from mahogany, maple, or other hardwood, making the bearing races exactly the same diameter and width in both parts. Drill four  $\frac{3}{4}$ " holes in the edge



Operating on ball bearings, the reel will turn as the yarn is pulled either for winding or knitting

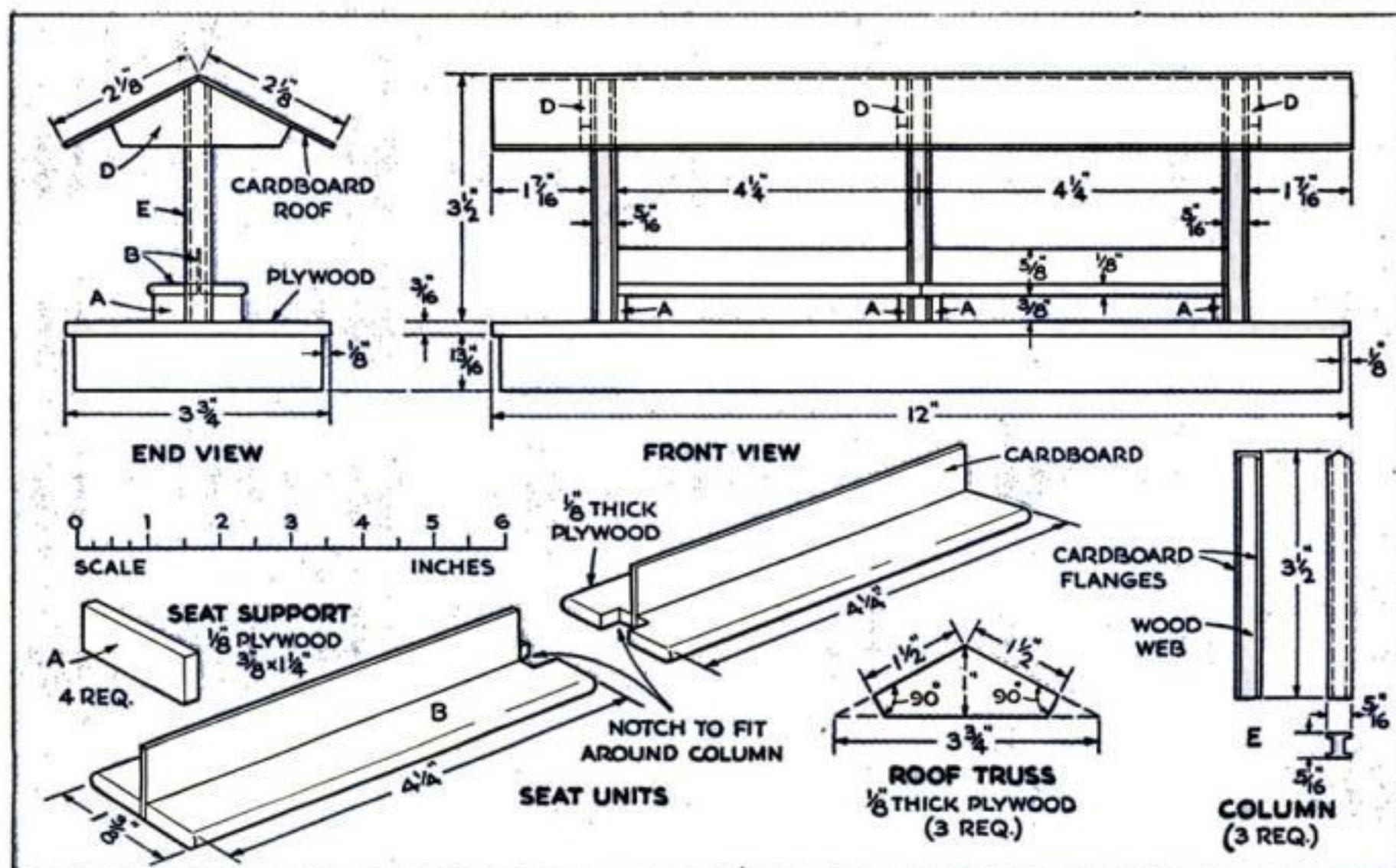


How the hub is turned to receive a ball bearing. Top of page, a plan to follow if marbles are used

of the top disk for the arms, one of which is made with three peg holes so that skeins of various sizes may be held. The other three arms have one hole each.

The bearing spacer is of  $\frac{1}{8}$ " thick plywood. Drill six equally spaced holes in it slightly larger than the marbles. Assemble the reel with a  $\frac{1}{4}$ " bolt to hold the parts together and press the turned cap in place to cover the bolthead.

The pegs are cut from maple doweling or, if a mahogany reel is being made, may be shaped from mahogany by hand. Finish the exterior parts of the reel with varnish or shellac, rubbed down and well waxed, or by any preferred method.—K. D. SPRAGUE.



## Small Stations for a Model-Railway Layout

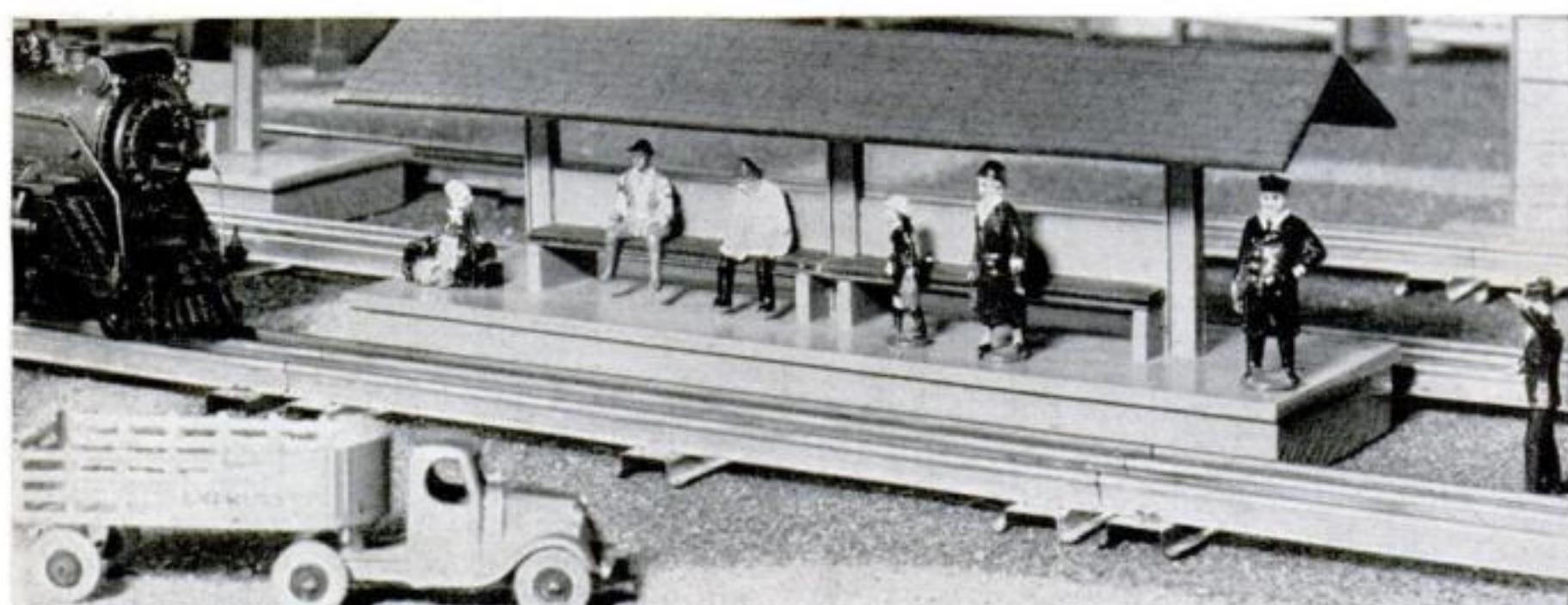
NO MODEL-RAILWAY layout is complete without one so-called "through passenger station" or passing station located somewhere between the main terminals. The design of the station illustrated, which is intended for "O" gauge, was adapted from an actual structure as a symmetrical unit so that two or more may be placed together to form a station as long as desired. Stations can also be placed on both sides of the track at an important stop. The dimensions may be altered to suit layouts in other scales as explained on the facing page.

Cut the roof from heavy cardboard, dye it with walnut water stain, and draw black lines on one side with a ruling pen to represent shingles. The roof columns are built up from thin wood and cardboard strips, ce-

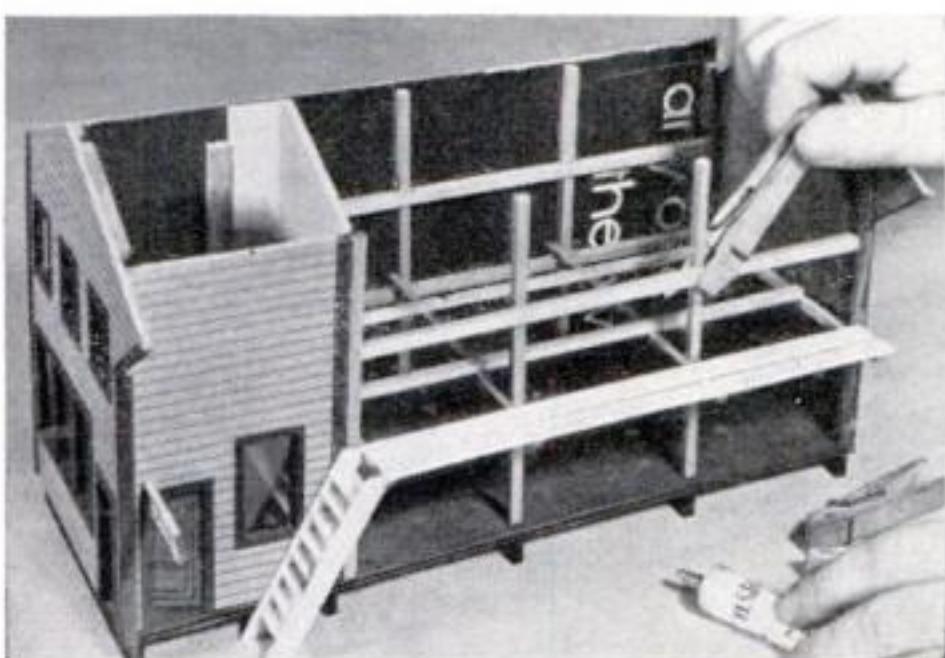
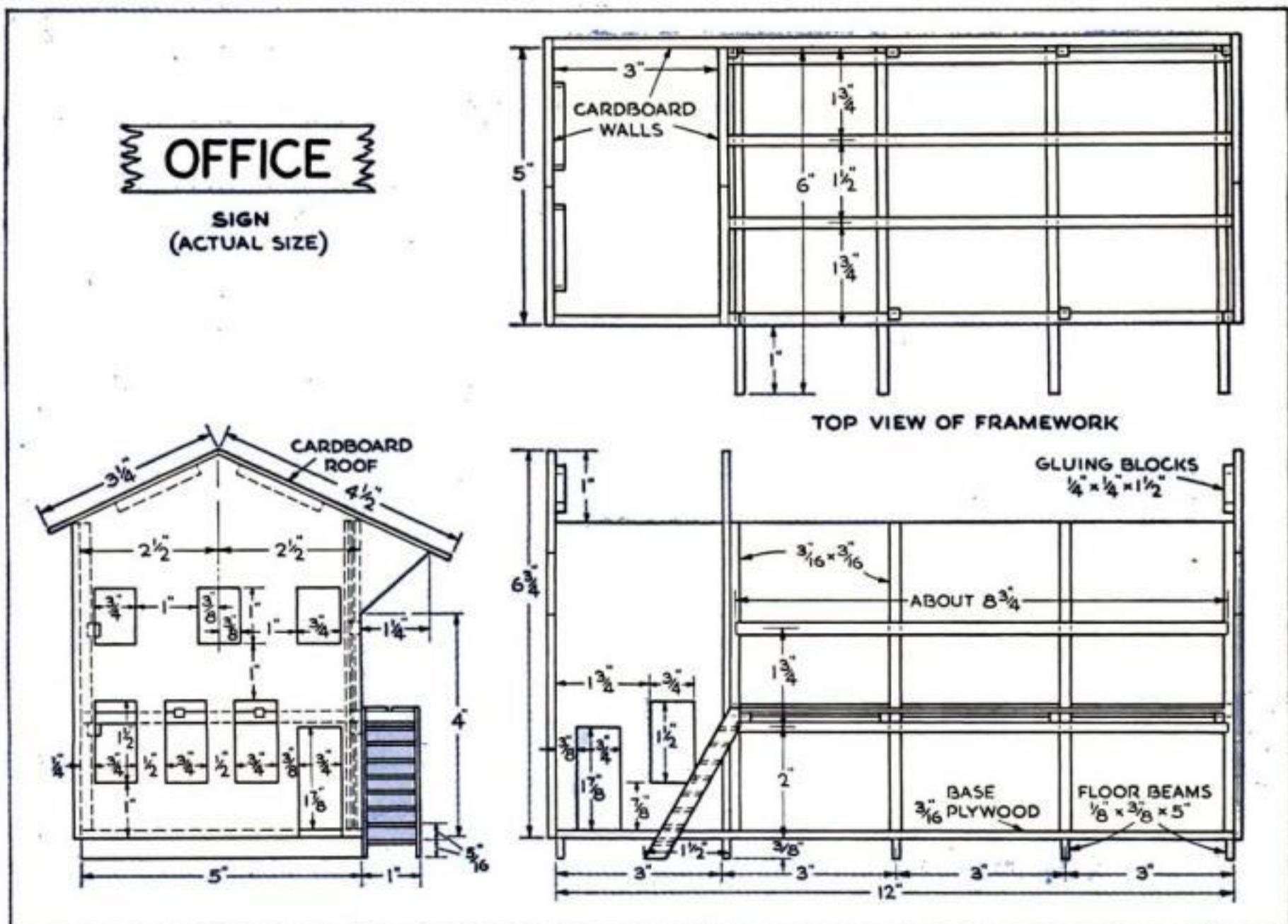
mented together, to simulate steel I-beams. The platform base may be solid or built up from cigar-box wood or plywood.

Using model-airplane cement and spring clothespins to hold the parts together while the cement is drying, fasten all seat supports and roof trusses to the columns as indicated. Notch the seats to fit around the center column and cement them to the cardboard seat backs. When the adhesive has set, cement both seat units between the columns to the seat supports. Center this assembly on the base. Then cement the two roof pieces to the trusses.

Columns and roof trusses may be painted gray; seats and supports brown or green. Small electric lamps installed under the roof will add much to the realism of the station.



# Trackside Lumber Shed Enlivens Model Scene



FEW accessories will add more to the appearance of your railway layout than this realistic lumber shed, which is scaled to "O" gauge. For "HO" gauge, halve the dimensions given; for "OO" gauge, make them one fourth larger than for "HO."

Draw walls, windows, and doors on heavy cardboard, cut out with a sharp knife and steel straightedge, and tint these parts a light brown with water colors or oil stain. Rule black lines  $\frac{1}{4}$ " apart (for "O" gauge) to simulate clapboard siding. Cement clear cellulose material over the window openings. Doors can be made of thin brown cardboard, ruled in imitation of panels, and glued by one edge inside the walls.

Saw the 5" by 12" base from plywood and glue the five floor beams to it. Cement the walls to the base and to each other along their vertical edges. Note that the front wall rests on top of the base, but the others are cemented to the sides of the base. The lumber rack consists of  $\frac{3}{16}$ " square wood strips. Four of the crosspieces extend 1" from the face of the shed to support the board walk. Uprights and stringers at the front are notched where they cross. Make the ladder of cardboard and cement it on.

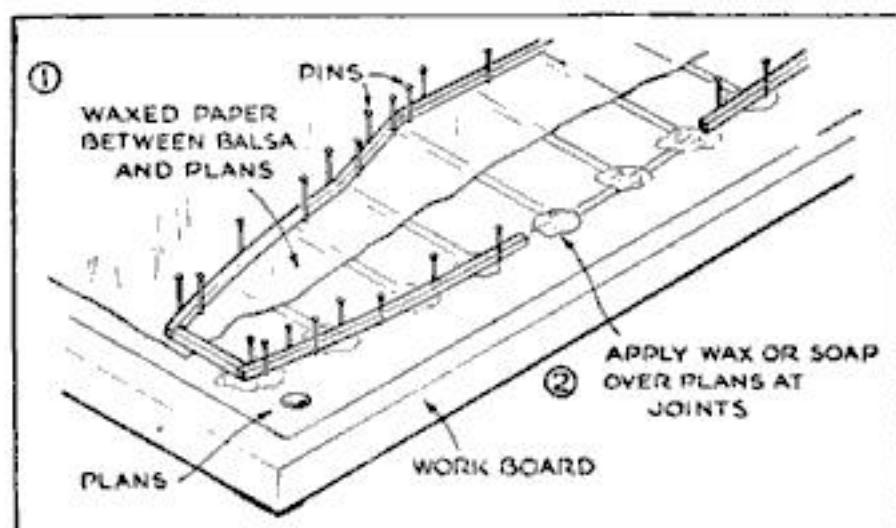
Windows and doorways are framed with

thin brown cardboard strips  $\frac{1}{8}$ " wide, and  $\frac{1}{4}$ " wide strips are cemented at the corners of the shed for trim. Cut the two roof pieces from  $1/16$ " thick cardboard. Carefully rule on lines to represent shingles; then cement the two roof pieces in place.

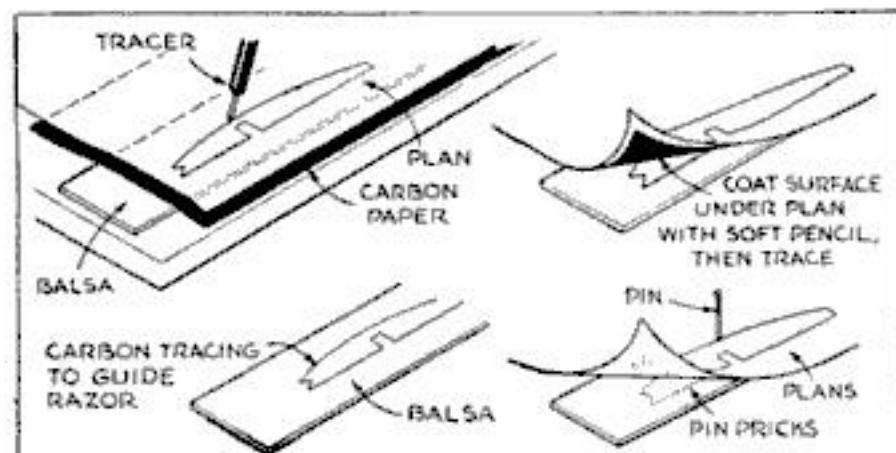
The fence consists of four horizontal wood

strips,  $1/16$ " thick and  $5/16$ " wide, glued to upright posts set 4" apart. Stain it brown to match the shed. The "office" sign can be traced off on cardboard and glued to a match stick inserted in a hole above the door. Be sure to rip plenty of "lumber" of various sizes to stock the shed.—C. E. BLACK.

## Practical Pointers on Building and Repairing Model Planes

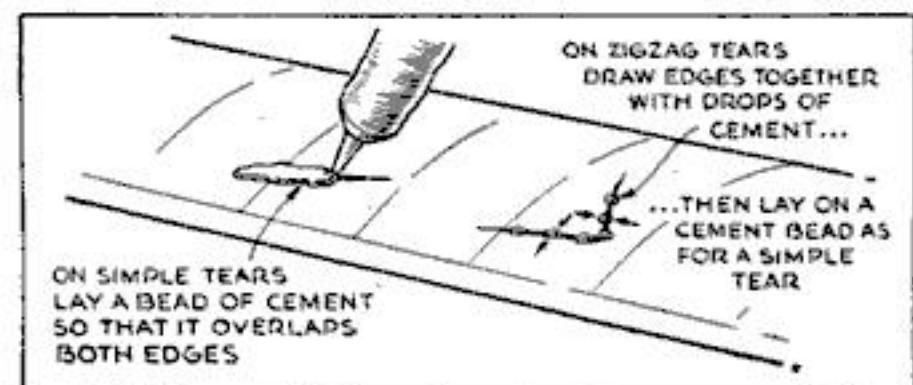


WHEN VARIOUS UNITS of a model airplane are constructed directly over the full-size plan, the parts will stick to it, and the drawings have to be torn to remove the work. To prevent this, either use wax paper between the work and the plan, or coat the latter with soap or wax at each place a joint is indicated. Remember that cement next to the plan does not set as soon as that on top because it is less exposed to the air; therefore allow some time to elapse after removing the work to let all the cement harden.

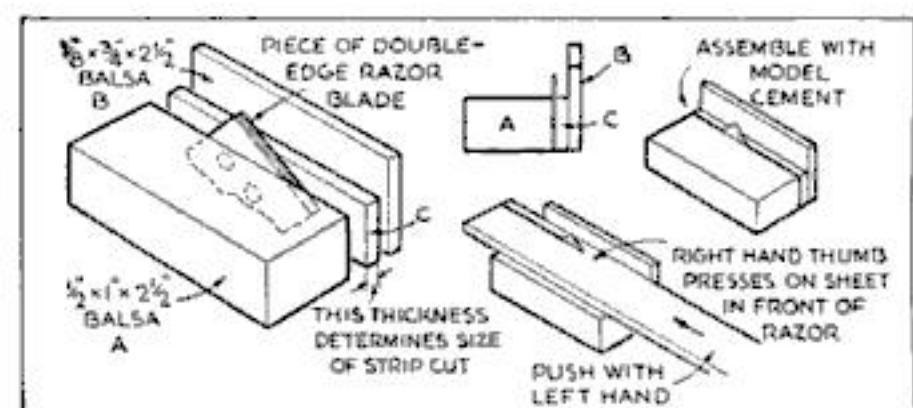


THERE ARE SEVERAL good ways to transfer outlines from drawings or printed plans to the stock from which parts are to be cut. If the plan is in a magazine or book and it is desired to avoid cutting or marking the pages, use carbon paper and a pointed tracer. Ordinarily, however, it may be found more convenient simply to blacken the undersurface of the plan with a soft lead pencil, and trace through with a pointed instrument or a very hard pencil. Another very accurate and often faster method is to prick through the outline into the wood at intervals with a pin or a mounted phonograph needle.

IF THE COVERING of a model airplane becomes torn, temporary or even permanent repairs can often be made with cement. When the tear is a simple one, apply a continuous bead of cement so that it overlaps both edges. This will usually draw the edges together

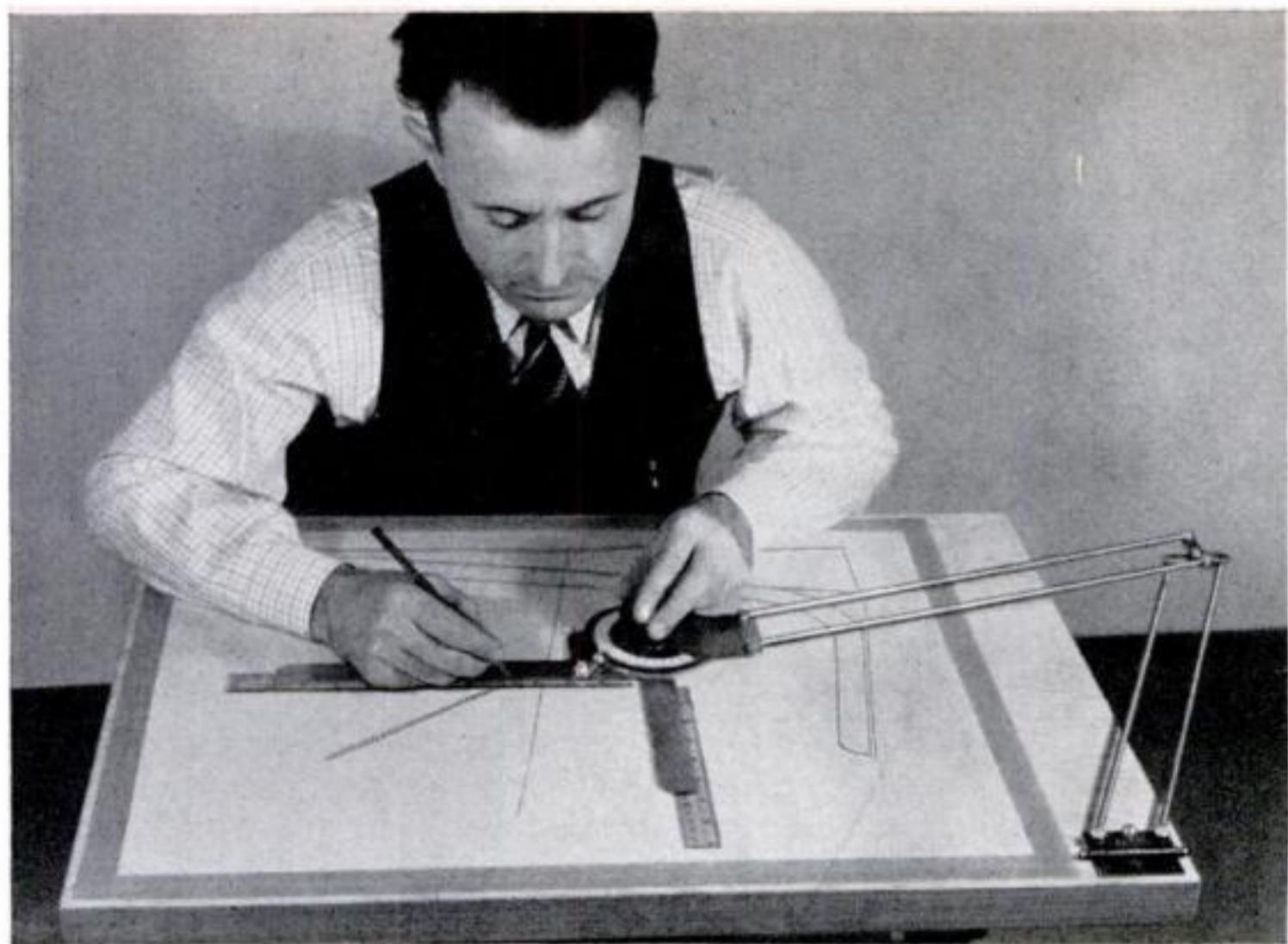


and remove the wrinkles. For a zigzag tear, draw the edges together with a few spots of cement, then apply a continuous bead of cement over them. Edges that are not in line can be pulled together with the end of a pin.



IN CONSTRUCTING model airplanes or other models in which strips of balsa wood are used, it is important to have several balsa strippers or cutters of different sizes. These can easily be made as shown above. They will cut all grades of balsa except that known as "rock hard." The strippers are especially useful when one has to order supplies by mail and cannot foretell just what width strips will be required.

APPLYING COLORED DOPE. Use several thin coats rather than one or two thick ones. Dope and brush should be of first-class quality. Keep cement off surfaces finished with colored dope; it will not hold well, and it loosens the color.—FRANK ZAIC.



No scales, triangles, T-square, or protractor is required when making drawings with this simple, practical drafting machine, and the work can be done in 40 to 50 percent less time. The square remains at a constant angle wherever it is placed on the board, and it can be set to any protractor reading

## Homemade Drafting Machine

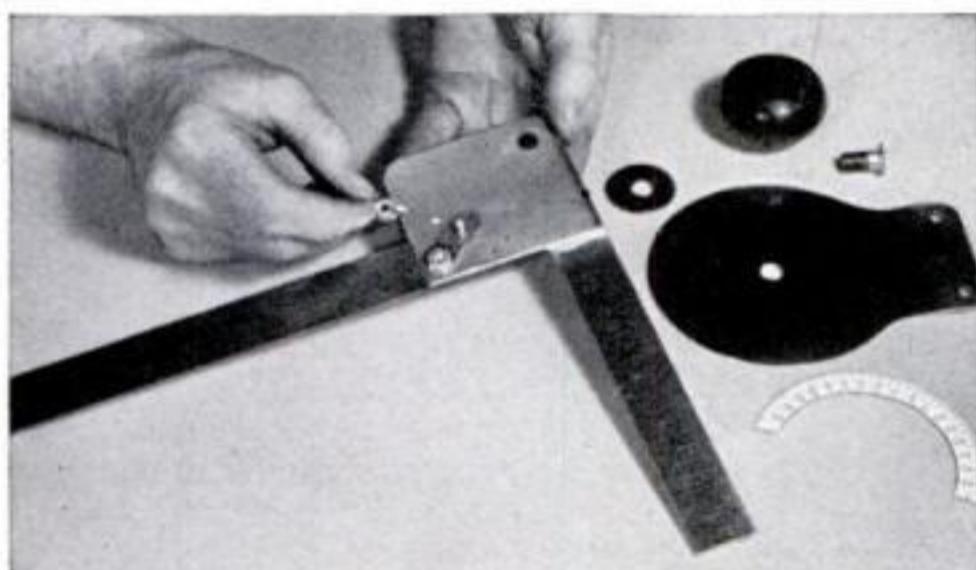
By L. C. PELTIER

A DRAFTING machine is a parallel-ruling machine which, by combining several of the most frequently used drawing tools in one instrument, enables a greatly simplified drafting technique to be employed.

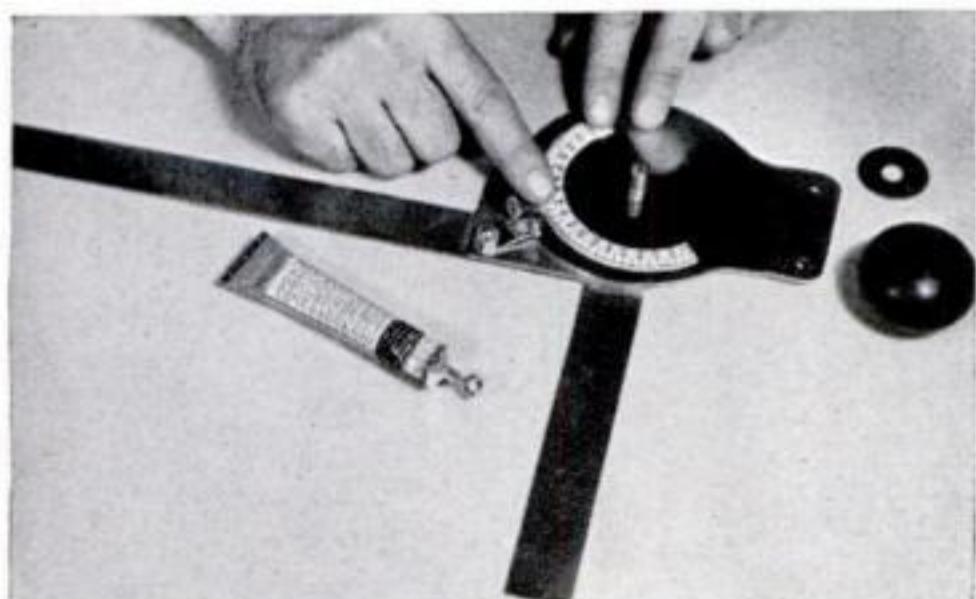
For practice work and ordinary shop drafting, a satisfactory machine can be made almost entirely from materials found in five-and-ten-cent stores. The machine illustrated consists of a ten-cent steel square, two celluloid rulers, a celluloid protractor, four tubular curtain rods, and a hinge, all from the "five-and-ten"; a gear-shift knob from a junk yard; a couple of pieces of sheet metal, and sundry screws, washers, and rivets. Dimensions are governed largely by the parts used and are not critical except in a few respects, which will be mentioned later.

A small plate of about 18-gauge sheet metal is soldered to the steel square as shown. Near one corner of this piece a  $5/16$ " hole is drilled to receive the control-knob bolt. The larger upper plate, which is circular with a rectangular projection at one side, serves as a mounting piece for the parallel arms and the protractor. Cut it to shape and drill a hole in its center for the control-knob bolt. Inasmuch as the instrument will pivot on this bolt when turned for laying out angles, both holes must be drilled to a very close fit to insure accuracy.

A  $5/16$ "-18 cap screw was used for the



First, solder a sheet-metal plate to the square. Note hole for pivot bolt, and clamping lug in the lowest corner. Upper plate appears at right above



Bevel the clamping lug and scratch a line on it as an indicator for the protractor, which can be fastened to the upper plate with cellulose cement

## HOW TO LEARN PROFESSIONAL DRAFTING TECHNIQUE

COUNTLESS mechanically minded men are studying drafting in order to advance themselves in the present upsurge of industrial mobilization. Most of them would like to gain experience in the use of the so-called "drafting machine," now universally found in large drafting rooms. First-class drafting machines are, of course, too expensive for the average man to purchase merely for practice work; besides, industry is using every available machine and all that can be manufactured.

A good solution has been worked out in this article by Mr. Peltier, who is himself an

expert draftsman, although better known as one of the world's foremost amateur astronomers. Mr. Peltier's suggestion is that students and mechanics make their own drafting machines. This can be done without much difficulty and at surprisingly low cost. While a handmade machine can hardly be expected to compare in accuracy or appearance with even medium-priced commercial machines, it will serve for practice work and ordinary drafting of the type done in small shops where a high degree of precision is not essential. The technique is the same as that required in using a commercial machine.

bolt as it happened to fit the threads in the gear-shift knob. The head of this cap screw is filed to about  $1/16$ " in thickness so that it will clear the drawing. The two plates are clamped together by tightening the control knob, and also by a small clip of 18-gauge metal, which is bent to an offset equal to the thickness of the upper plate. A flathead stove bolt, countersunk flush on the underside, secures this clamp to the square. The clamping bolt, also countersunk, is fitted with a wing nut.

Round the outer corners of the steel square as shown. Cement the protractor to the upper plate, and cement the celluloid scales to the underside of the square, cutting one to 8" in length and notching the other to clear the screw heads. Inasmuch as cheap squares are none too accurate, it is best to check the scales against accurately drawn right-angle lines before the cement sets. Afterwards, the scales can be further secured with small flush tubular rivets.

The parallel arms, which are made from tubular curtain rods, are all cut to exactly the same length, which will depend upon the size of the drawings to be made. The arms shown are  $16\frac{3}{4}$ " between rivet centers—more than ample for drawings 17" by 22".

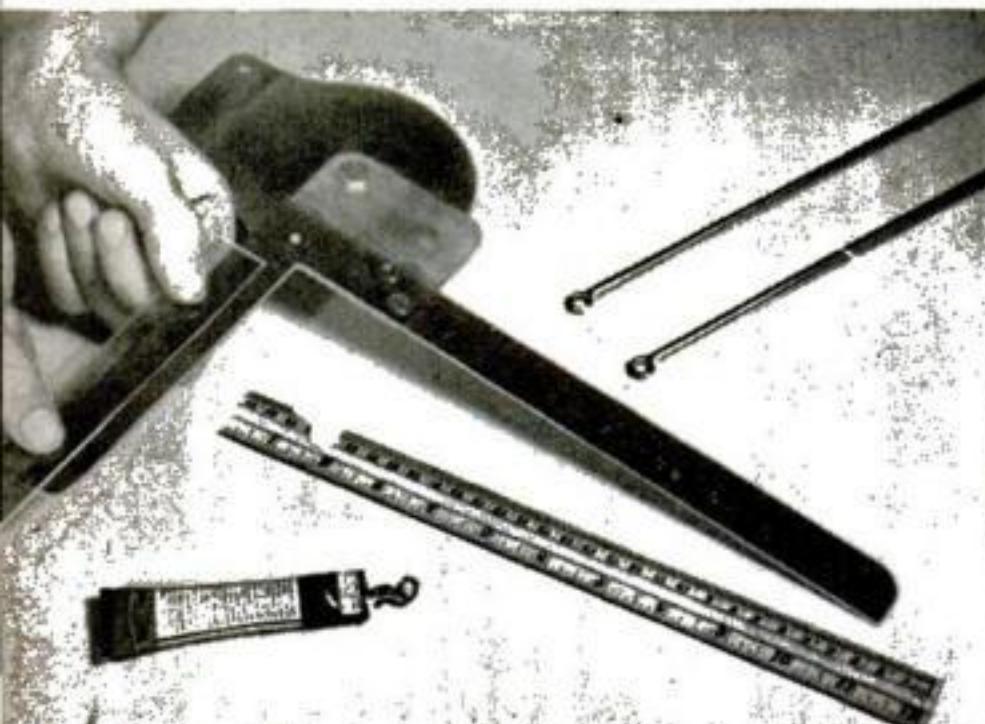
Cement the scales to the underside of the square at precisely a right angle. The arms are made by soldering screw eyes to the ends of curtain rods

It is best, although not essential, if these arms are of seamless tubing. Solder large screw eyes into both ends of each rod, taking care that both screw eyes on any rod lie in the same horizontal plane. They should be of a size to accommodate a solid rivet approximately  $\frac{1}{4}$ " in diameter. Since the accuracy of the machine depends on the close fitting of these riveted ends, special care should be taken that the rivets are all drawn up fairly tight, with no excess play or lost motion. After the joints are riveted, a little oil on each will make all work smoothly.

The machine is fastened to the drawing board with a cabinet hinge having a fairly long and close-fitting pin. One leaf of the hinge is reversed to give clearance for the rivets. As the outer holes of the hinge happened to be  $1\frac{1}{8}$ " apart in this case, both pairs of arms were spaced this distance apart. The center hole in the hinge leaf is tapped to receive a  $\frac{1}{4}$ " stove bolt, which serves as an adjustable stop to keep the arm assembly from resting on the drawing board.

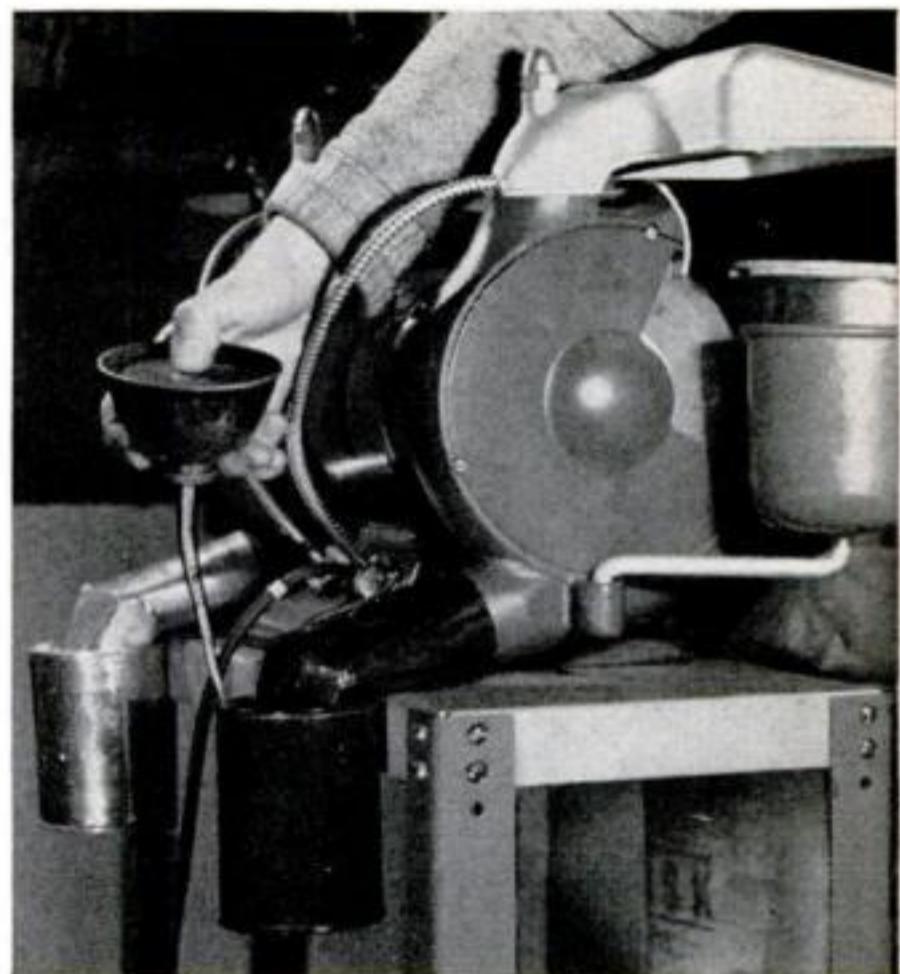
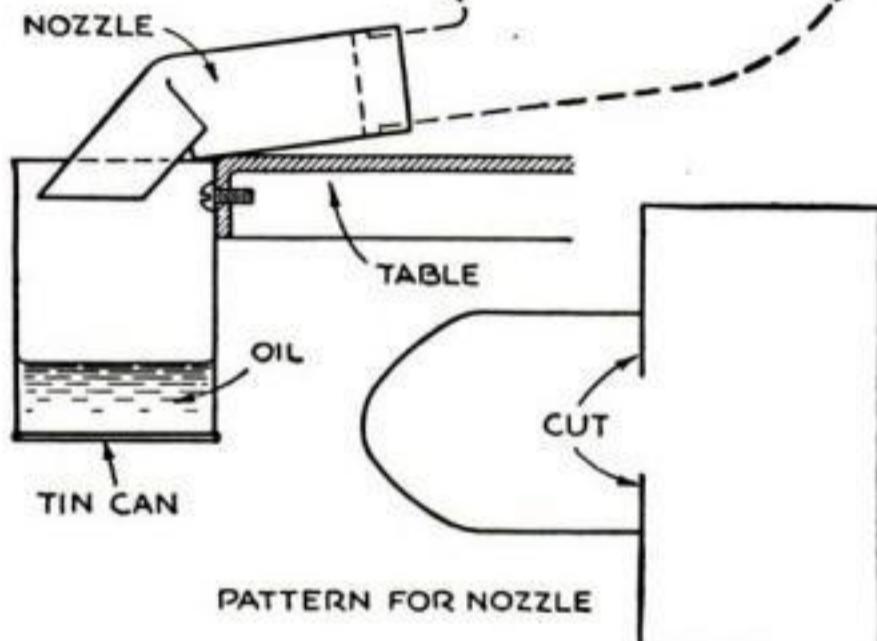
The elbow hinge consists of two strips of 16-gauge metal set at right angles, with a couple of washers between to serve as spacers. These pieces are riveted together to form a rigid unit.

The elbow joint is riveted and soldered at its middle. All other rivets must permit movement of the parallel arms, but without any excessive play



## Tin Cans Catch Grit and Dust from Grinding Wheels

Both dust traps can be bolted to the edge of a grinder stand as shown. Cement sheet rubber inside the nozzle to shield it from the fast-flying particles



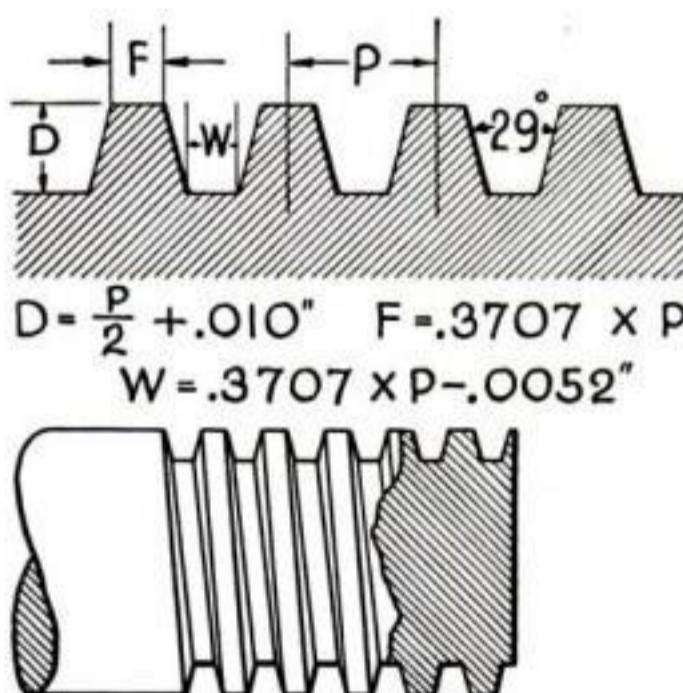
FOUR or five tin cans provide the material for an efficient dust catcher on a bench or pedestal grinder. Two cans, partly filled with automobile-engine oil, entrap and hold the gritty dust. The others furnish metal for making tubes or nozzles to carry the dust from the outlet openings in the wheel guards to the oil containers.

Mount two of the cans behind and somewhat below the dust outlets. On most grinders these are so shaped that a cloth bag or other dust catcher can be tied around them. When the grinder is on a steel stand,

the two cans are fastened by running a  $\frac{1}{4}$ " or  $\frac{3}{8}$ " bolt through a hole near the top of each and into tapped holes in the edge of the stand.

Shape the connecting tubes so they will slip over the dust outlets, with their outer ends curving down into the oil reservoirs. To prevent the grit from sand-blasting the inside surfaces of the tubes where they curve downward, apply adhesive tape or a thin sheet of rubber. Into the oil reservoirs pour about 1" of moderately heavy oil. Empty whenever dust accumulates.—W.E.B.

### ACME SCREW THREADS AND FORMULA [LATHE WORK-23]



The Acme thread is used extensively for feed and adjusting screws on machinery, and is replacing the square thread in many instances because it is easier to cut. The included angle between the sides is 29 deg. As the accompanying formula shows, the depth is made equal to one half of the pitch plus 0.010" in order to provide clearance between the top of the screw thread and the bottom of the thread groove in the nut.

Cutting an Acme thread is similar to cutting a 60-deg. type thread. The tool must be set at 90 deg. to the work with an Acme thread gauge. However, lighter cuts are taken than when cutting 60-deg. type threads, because the total cutting face of the tool is longer.

# MACHINISTS

## How to Make Lathe Mandrels

A SET of mandrels such as shown in Fig. 1 is a good practice project for beginners in machine-shop work. Cut tool-steel stock to length and centerdrill it as in Fig. 2. This must be done with the utmost accuracy since it is necessary that the outer shell left from the rolling process be uniformly turned off. Mount between centers and rough-turn as in Fig. 3. The piece is then pack annealed to eliminate any internal stresses. Replace it in the lathe and bring it to size with several light cuts, leaving it about 0.002" oversize to allow for grinding afterwards.

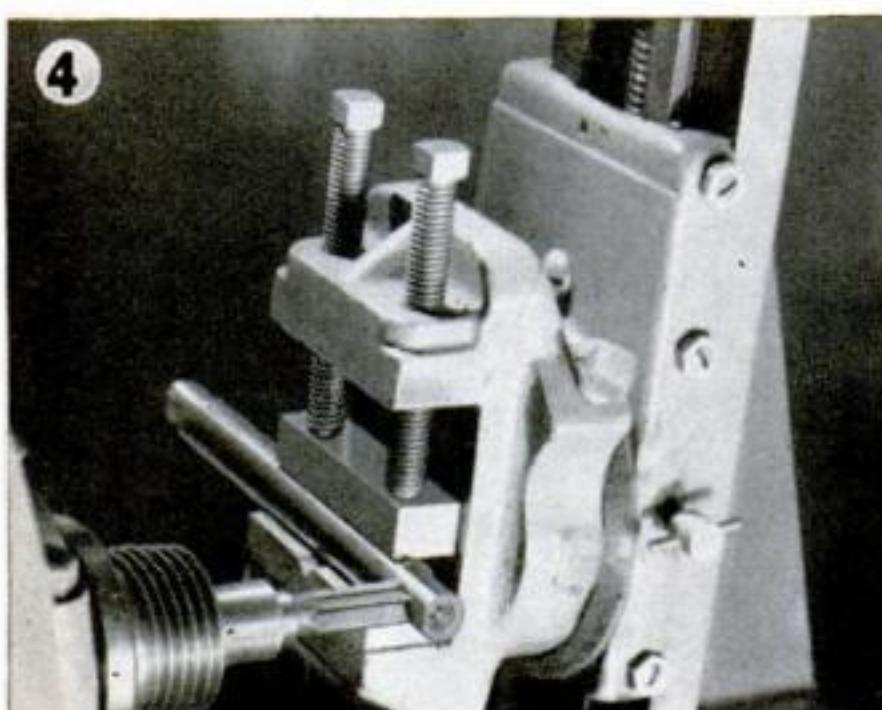
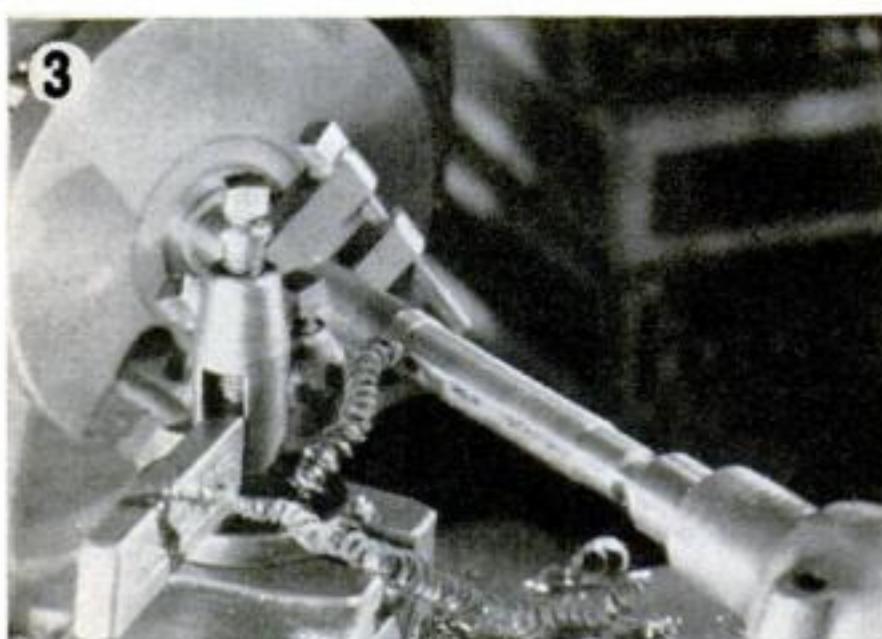
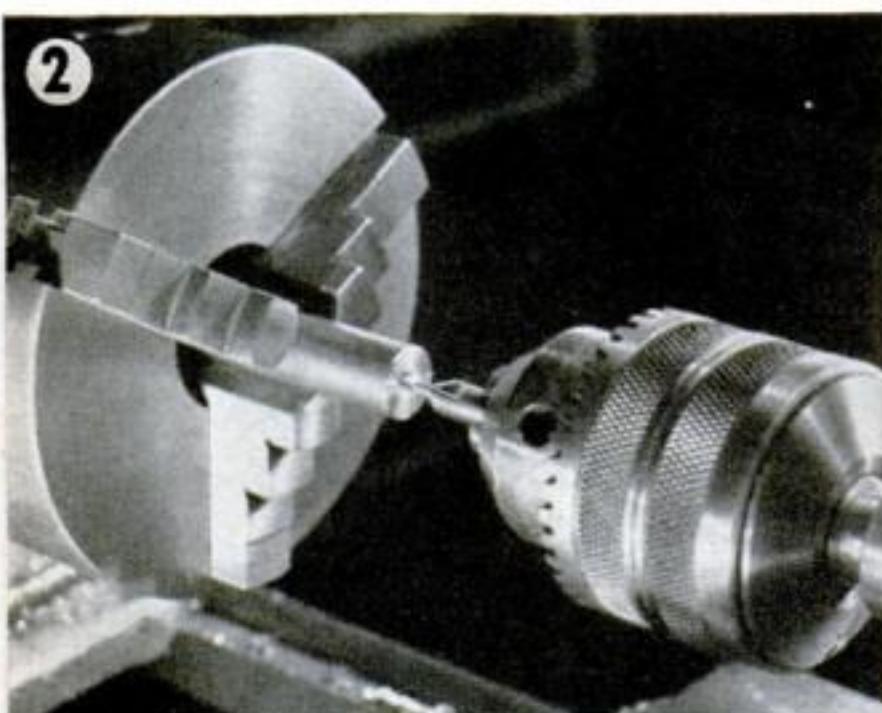
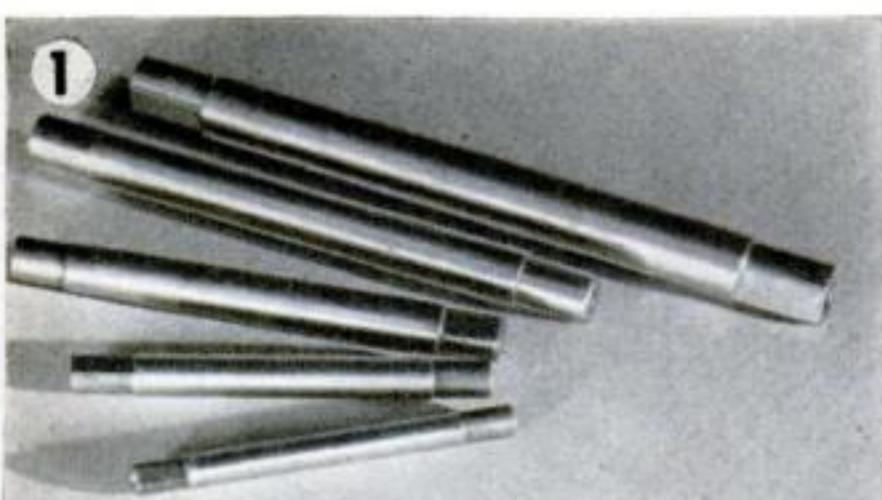
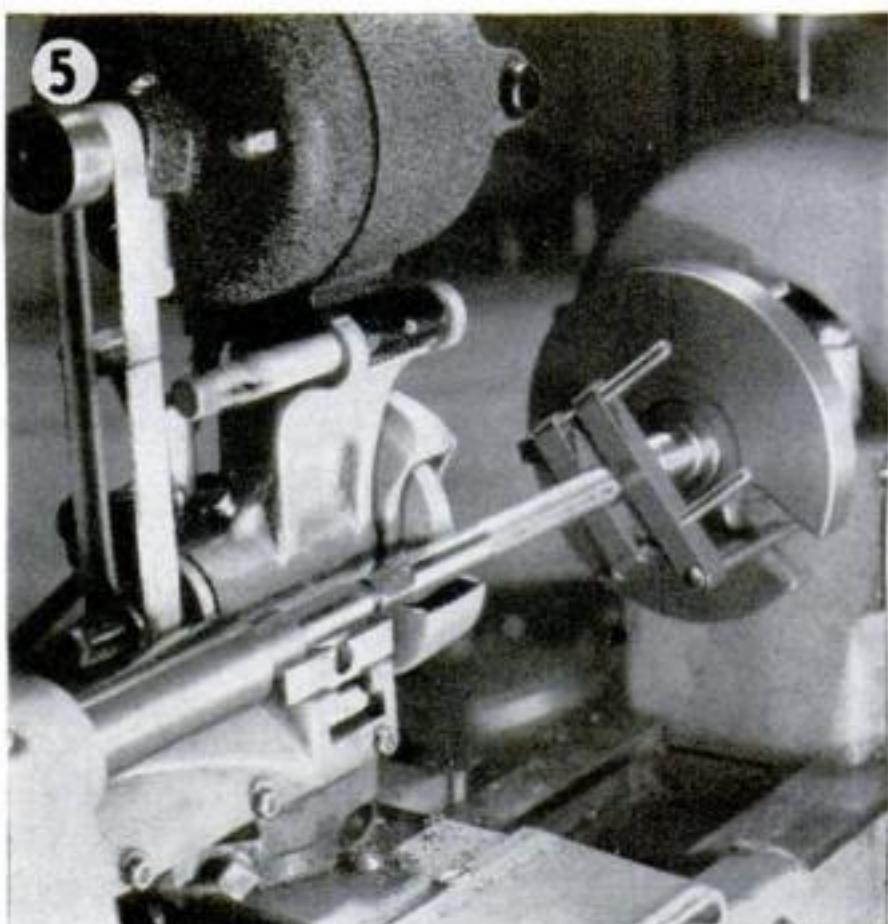
Ream and counterbore the holes in the ends very carefully, as the accuracy of the mandrel depends upon their being concentric with the outer diameter. The flat on each end for the set screw of the lathe dog can be carefully filed or cut with an end mill as in Fig. 4.

Mandrels are usually tapered 0.006" per foot and always have the size stamped on the large end. After it has been marked thus, the mandrel can be hardened and tempered, then mounted between centers and ground to the proper taper and final size with the tool-post grinder as in Fig. 5.

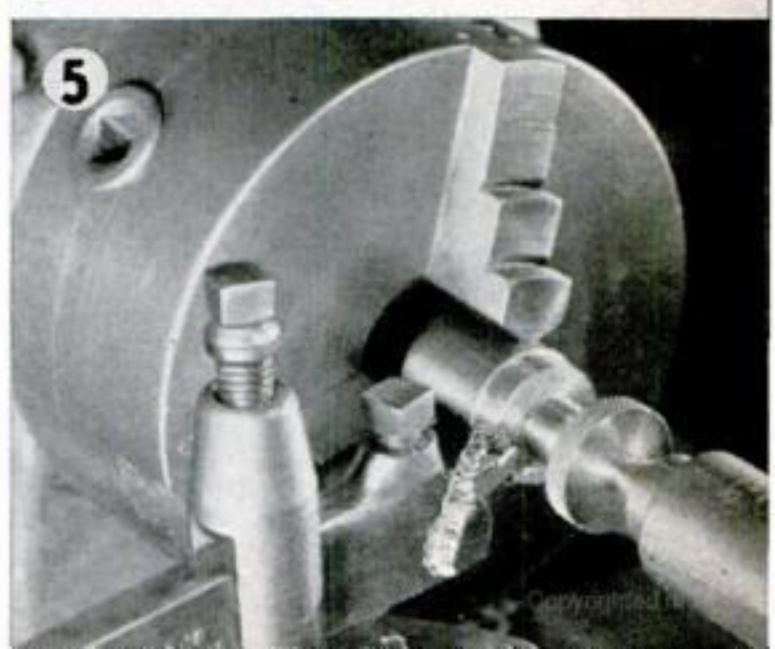
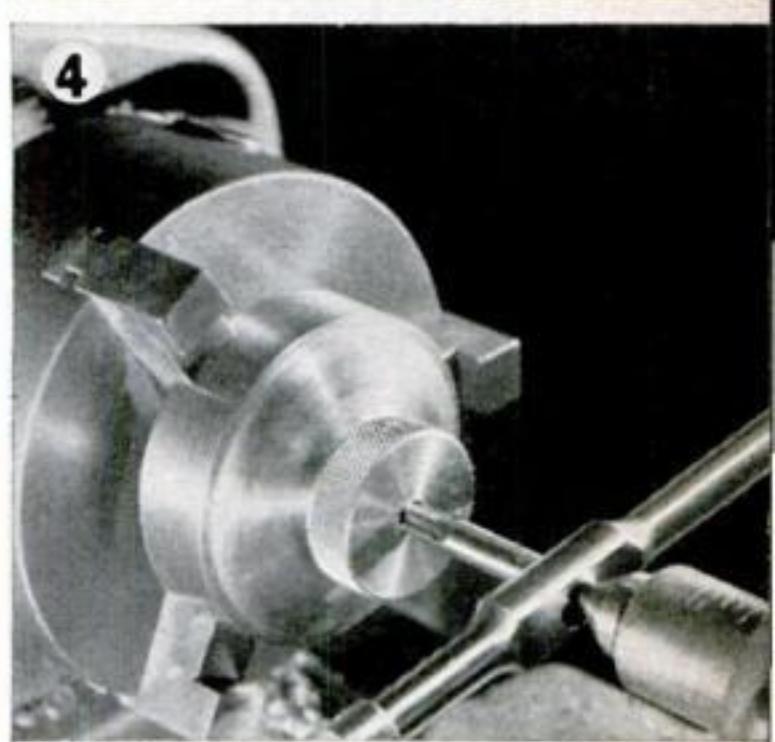
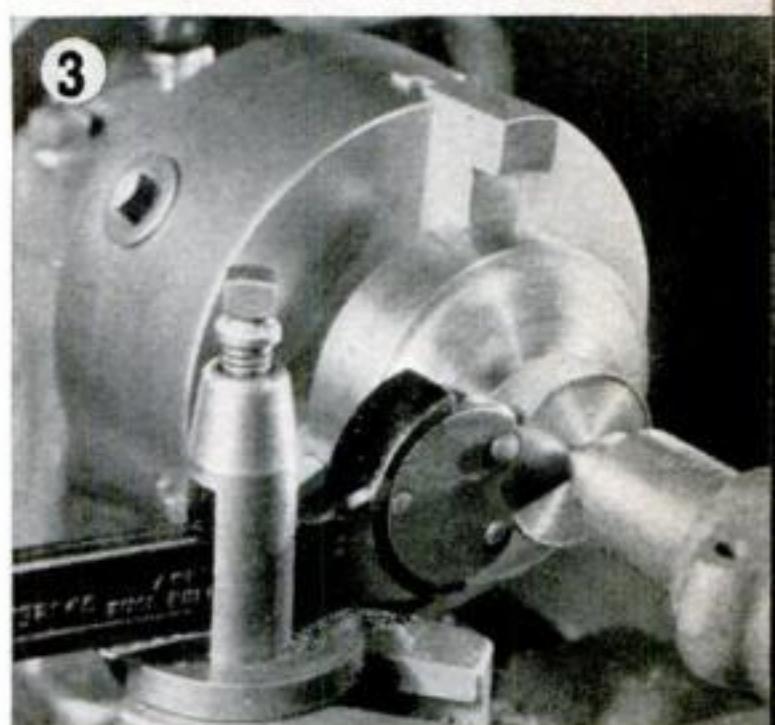
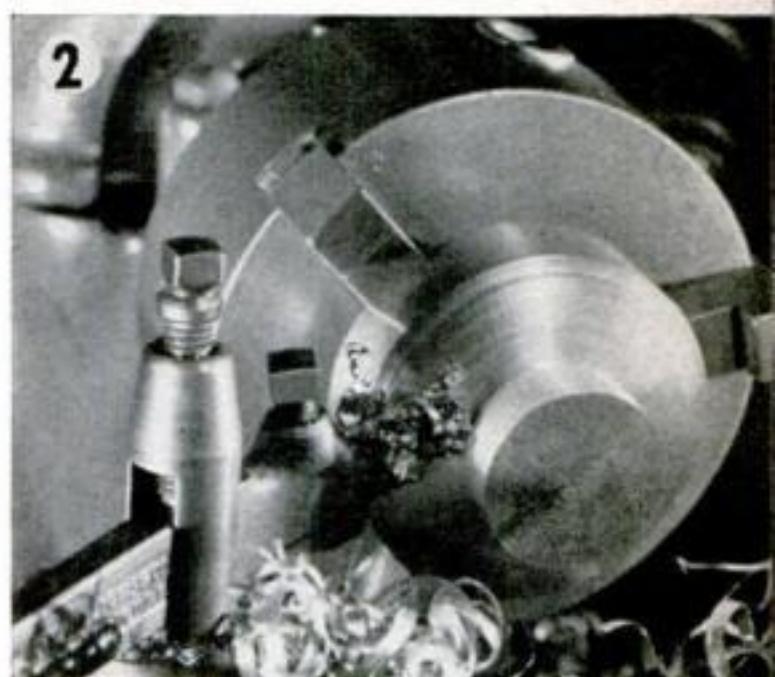
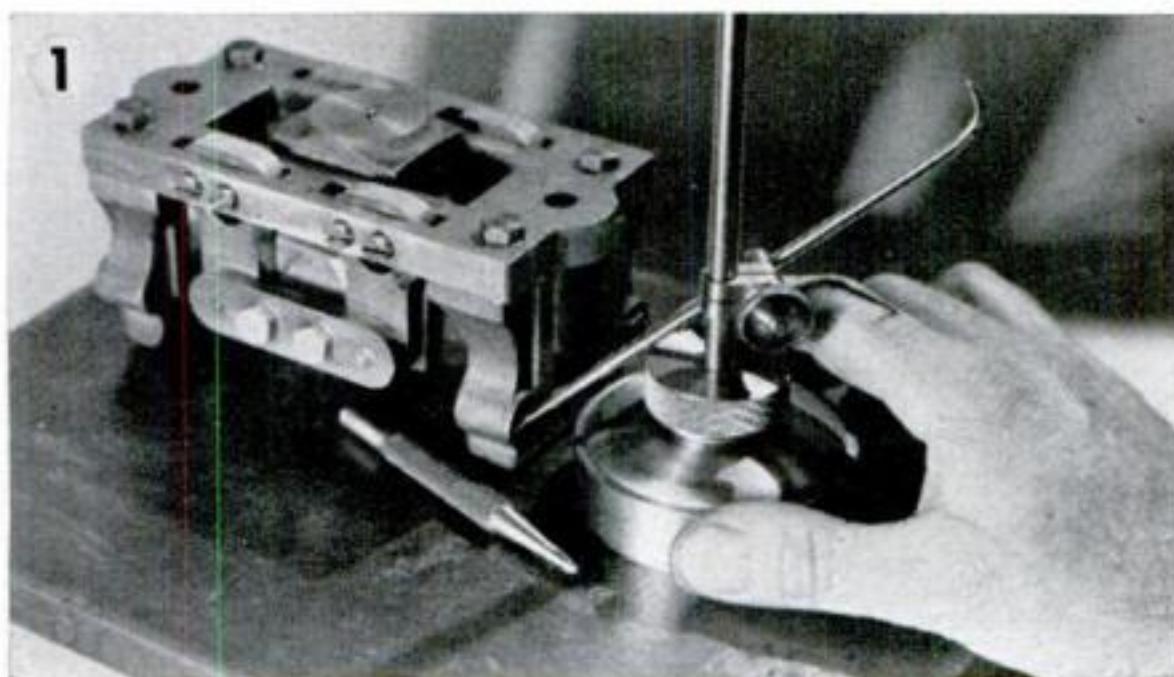
## Constructing a Surface Gauge

COLD-ROLLED steel was used for the base, and drill rod for the spindle and scribe of the surface gauge (Fig. 1 on the facing page).

Chuck the base stock and turn it (Fig. 2) to the dimensions in the drawings; next



# FOR DEFENSE

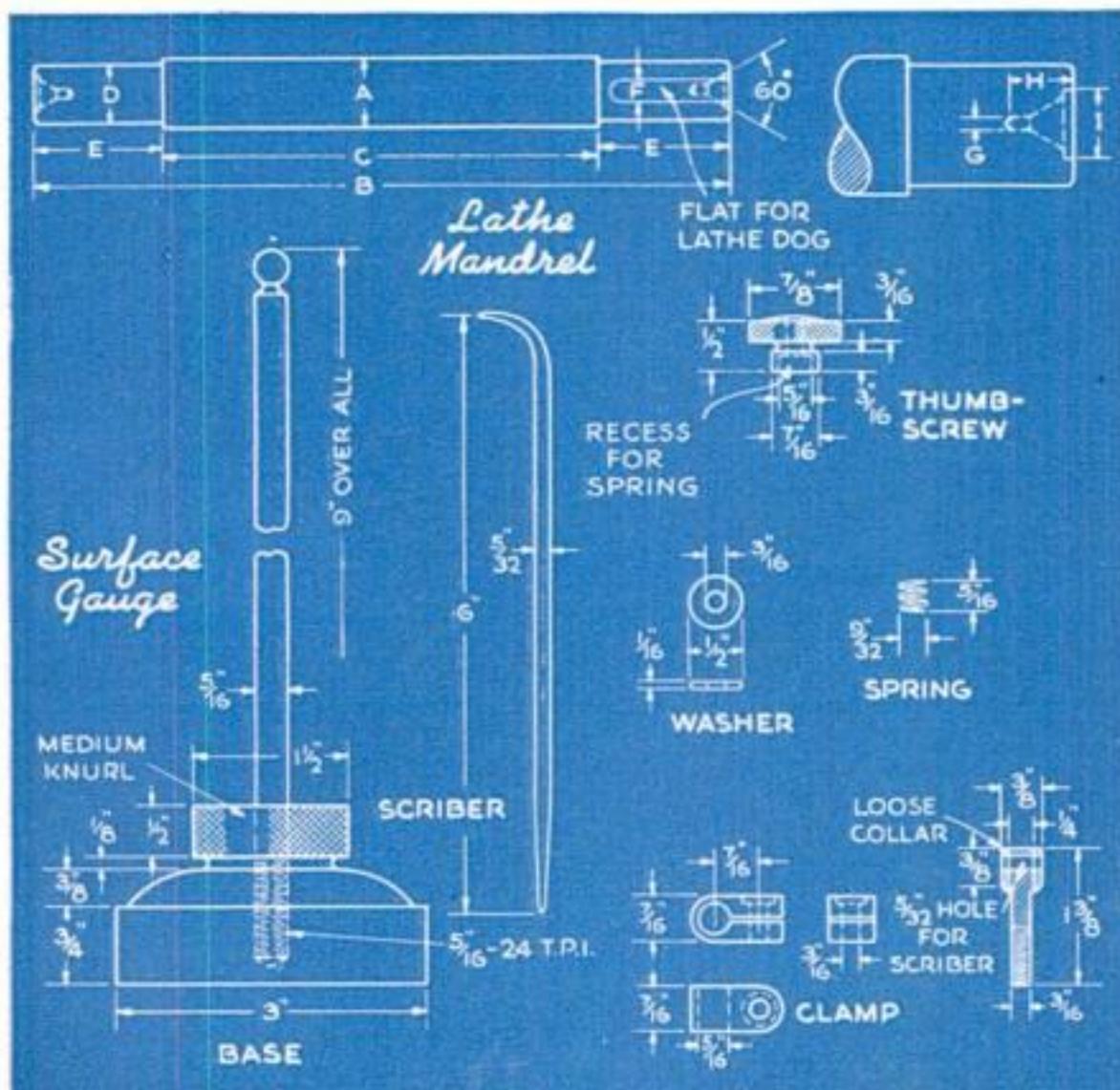


drill a center hole for tail-stock support and knurl the knob (Fig. 3). The piece is then centerdrilled 0.272" and tapped 5/16"-24 in the lathe, as shown in Fig. 4.

Turn the knurled thumbscrew from solid bar stock (Fig. 5), drill and tap it 3/16"-24 and cut it off. Make the clamp assembly from mild steel. Turn both spindle and scribe from drill rod in the lathe. The spindle is threaded on one end to fit the base. After bending the scribe to shape, harden and temper the points. Note that the scribe passes through a hole in a loose collar slipped over the clamping screw. A wedging action clamps the scribe in any position when the thumbscrew is tightened. Use the gauge on a surface plate as in Fig. 1.—C. W. WOODSON.

## DIMENSIONS FOR SOLID LATHE MANDRELS

A	B	C	D	E	F	G	H	I
1 <sup>4</sup> / <sub>16</sub>	4	2 <sup>3</sup> / <sub>8</sub>	7/32	13/16	5/64	.046	1 <sup>1</sup> / <sub>8</sub>	3/16
5/16	4 <sup>1</sup> / <sub>4</sub>	2-9/16	9/32	27/32	3/32	.052	5/32	13/64
3 <sup>8</sup> / <sub>16</sub>	4 <sup>1</sup> / <sub>2</sub>	2 <sup>3</sup> / <sub>4</sub>	11/32	7/8	1/4	.055	3/16	7/32
7/16	4 <sup>3</sup> / <sub>4</sub>	2-15/16	3/8	29/32	9/64	.059	7/32	15/64
1 <sup>1</sup> / <sub>2</sub>	5	3 <sup>1</sup> / <sub>8</sub>	7/16	15/16	5/32	.063	1 <sup>1</sup> / <sub>4</sub>	1 <sup>1</sup> / <sub>4</sub>
5 <sup>9</sup> / <sub>16</sub>	5 <sup>1</sup> / <sub>2</sub>	3 <sup>1</sup> / <sub>2</sub>	9/16	1	3/16	.073	5/16	9/32
3 <sup>4</sup> / <sub>8</sub>	6	3 <sup>7</sup> / <sub>8</sub>	21/32	1-1, 16	15/64	.079	3 <sup>8</sup> / <sub>16</sub>	5/16
7 <sup>7</sup> / <sub>8</sub>	6 <sup>1</sup> / <sub>2</sub>	4 <sup>1</sup> / <sub>4</sub>	25/32	1 <sup>1</sup> / <sub>8</sub>	9/32	.089	7/16	11/32
1	7	4 <sup>5</sup> / <sub>8</sub>	7/8	1-3/16	5/16	.096	1 <sup>1</sup> / <sub>2</sub>	3 <sup>8</sup> / <sub>16</sub>



## Lead Weights Stop Brake Drums from Vibrating in Lathe

MECHANICS are all familiar with the tool chatter encountered when turning brake drums on a lathe. Various methods of deadening the vibration of the drum while turning it are used, but most of these require some time to install, are too much like a makeshift in appearance to be tolerated in a good shop, or lack sufficient weight to do an efficient job.

The method illustrated avoids these difficulties and combines all the features desired, including ease of installation on the drum. Four lead blocks  $\frac{1}{2}$ " by 2" by 6" are cast in a mold, with a piece of  $\frac{1}{8}$ " welding rod extending lengthwise through each block far enough to enable a loop or hook to be bent at each end.

To each block a piece of heavy leather belting is fastened with countersunk rivets. The blocks are then bent into a slight arc to fit the outside diameter of the brake drums. Four medium-heavy pull springs are hooked



Four lead blocks are held on the brake drum by means of coil springs

into the loops of the welding rod of each block to hold them snugly to the drum while it is being turned. Just one end of one spring needs to be unhooked to remove the blocks from the drum, and the four blocks can be hung together on the tool board for use whenever needed.—E. S. HARRIS.

## Ball-Bearing Spindle Designed for High-Speed Service

BOTH professional and amateur machinists may occasionally be required to construct spindles capable of running at 10,000 to 40,000 r.p.m., such as are used in tool-post grinders. However, designing such a spindle is not the simple matter it may appear at first glance. Even apparently sound construction may fail to stand up under continuous operation for long periods.

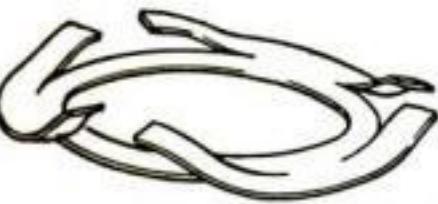
A well-designed spindle of this type is shown in the accompanying drawing. It is not difficult to make, but embodies all the essentials for satisfactory high-speed duty, and the dimensions can be changed as necessary to

suit the requirements of any specific job.

As double-row ball bearings are not recommended for speeds higher than about 10,000 r.p.m., standard No. 202 single-row bearings are used. The spindle is of the preloaded type.

The housing is bored a snug fit for the bearings, but the recesses are deep enough to leave considerable clearance between bearings and end caps. End play is taken up and the spindle "loaded" by inserting a loading spring behind one bearing. Both ends of the spindle are provided with collars that bear against the inner bearing races. The end caps are bored with ample clearance for these collars.—M. MIDDLETON.

This spindle, of the so-called "preloaded" type, can be operated safely at speeds up to 40,000 r.p.m.



No. 202 SINGLE-ROW BEARING, BORE 5906", OUTSIDE DIA. 1.3780", WIDTH .4331"

# Adjustable GROWLER

*Tests Large and Small Armatures*

By HAROLD P. STRAND

FOR testing the armatures of vacuum-cleaner, electric-drill, or other commutator-type motors, "universal" fans and motor-driven kitchen appliances, and automobile starters and generators, what is called a "growler" is generally used. With this device it takes very little time to find a short-circuited coil, a "short" between coils, and other defects that are not visible to the eye but may cause sluggish operation or possibly complete failure of the motor.

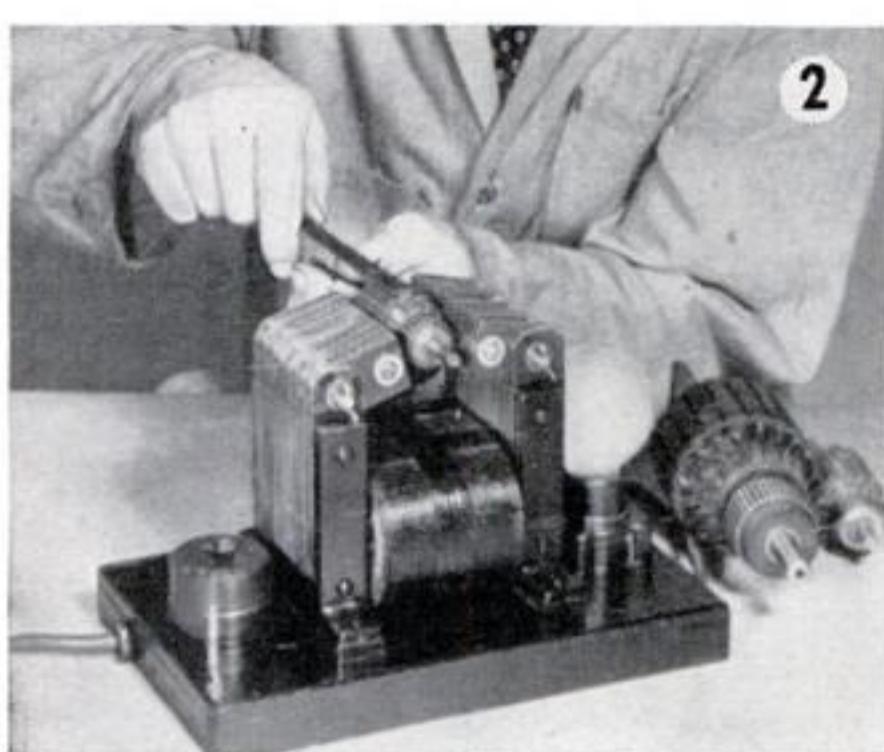
Any armature having commutator bars or segments separated by insulating strips, whether from a direct- or alternating-current motor, can be tested on a growler. It is necessary, of course, to remove the armature and place it on the growler, which, in principle, works much like an ordinary transformer.

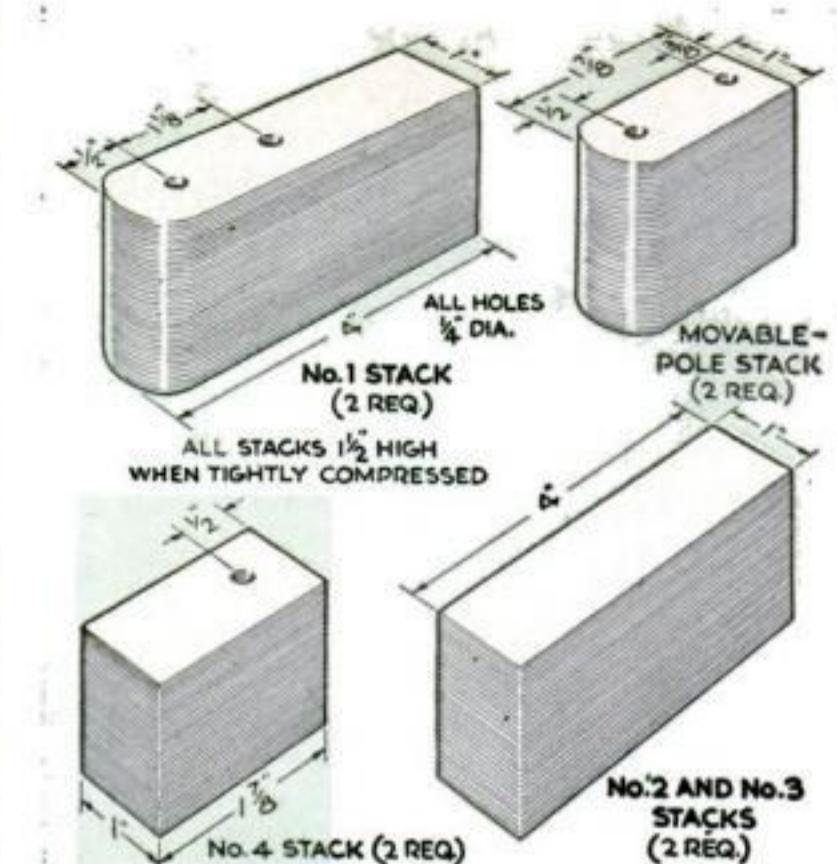
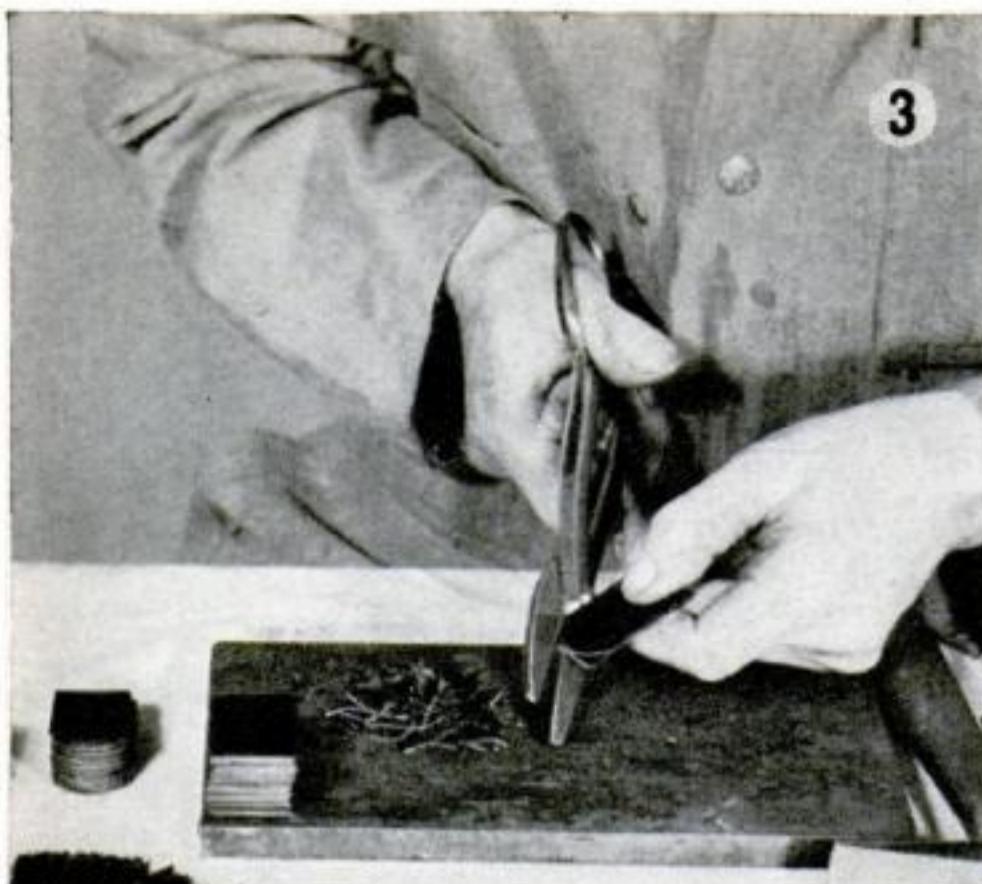
The laminated core of the device is open



at the top, forming two poles. A 110-volt A.C. source is connected to the growler winding, and the armature to be checked is placed between the poles so that its iron core closes the magnetic circuit. Now the armature coils act as a secondary winding. A current is induced in them, but cannot flow unless a short circuit exists. If this is the case, an old hack-saw blade or other thin piece of steel will be attracted to the armature core where the defect occurs. If the armature is electrically in good condition, the blade will not be attracted. Fuller directions for the use of the growler will be given later on.

Besides being of the most efficient design, the shopmade growler illustrated has the great advantage of being adjustable. It will accommodate armatures from about  $1\frac{1}{4}$ " to 5" in diameter (see Fig. 1 and Fig. 2). This is possible because the ends of the laminated poles are hinged in such a way that they can be moved to vary the gap between them. Because of its wide range, the growler should be found very useful in the electrical repair shop. Even the home mechanic who does not intend to rewind armatures himself will find it convenient for diagnosing motor troubles quickly. Its usefulness in the com-





Each stack may be clamped between two pieces of  $\frac{3}{8}$ " thick hardwood, cut to the same size as the laminations. Tap the metal pieces to align their edges and secure them to the drill-press table. One of the side irons, two of the 4" stove bolts, and a C-clamp may be used for this, as shown in Fig. 4.

Check the stack carefully to see that it is precisely square with the table. Use a new drill, preferably one made of high-speed steel, at the lowest speed possible. Avoid forcing it, which may tear the sheet iron.

#### LIST OF MATERIALS

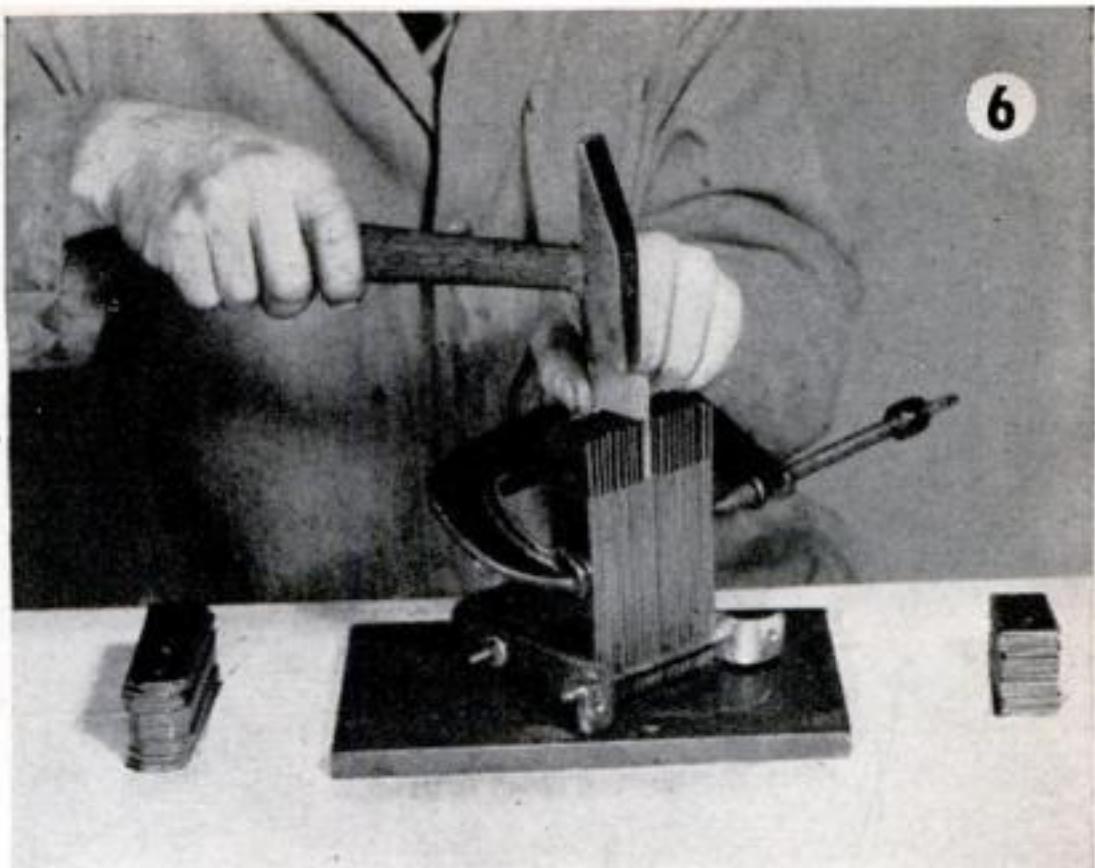
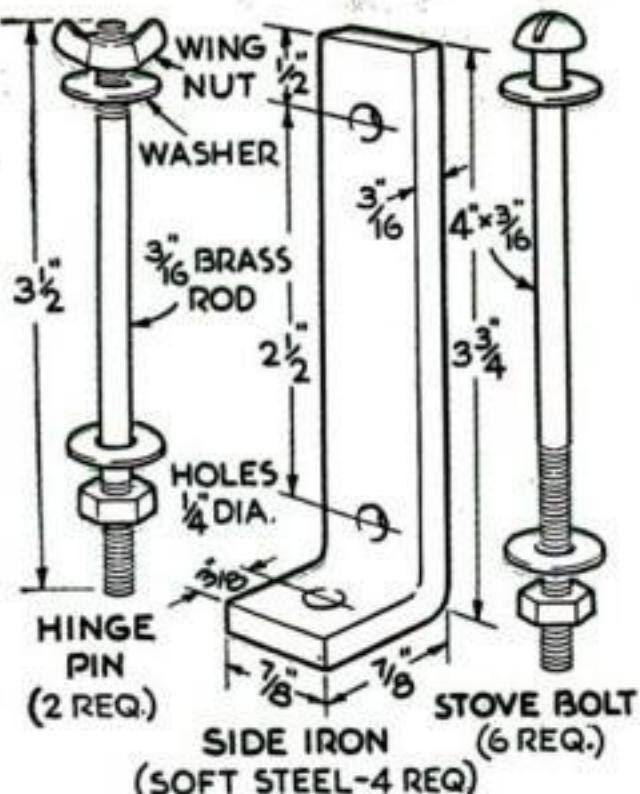
About 11 lb. of 28-gauge black stovepipe iron  
 3 1/2 lb. of No. 15 S. C. E. (single cotton, enamel) magnet wire  
 4 pc. 4 3/4" by  $\frac{7}{8}$ " by 3/16" soft steel or iron  
 6-4" by 3/16" roundhead stove bolts  
 2 pc. 3 1/2" by 3/16" brass rod  
 About 90 iron washers, 3/16"  
 4-1" by 3/16" roundhead stove bolts  
 1 surface lamp receptable  
 1 surface-type toggle switch  
 2 composition bushings,  $\frac{3}{8}$ "  
 8' No. 18 two-wire rubber-type SJ (constant service) cord  
 6' No. 18 flexible insulated wire  
 10" No. 10 rubber-covered solid copper wire  
 Miscellaneous: small pieces of  $\frac{1}{2}$ " or  $\frac{3}{8}$ " oak, maple, or plywood; attachment plug cap; varnished cloth; wing nuts and hexagon nuts; screws; paint; rubber tubing.

mercial garage is, of course, quite obvious.

To make the core, have a tinsmith cut some 28-gauge black stovepipe iron into strips 1" wide with his foot-power shears. Machine cutting is necessary to insure straight and square edges. About 11 lb. of metal will be required. The strips should then be cut by machine into pieces of the size shown in the drawings. Four stacks of 4" pieces and four stacks of  $1\frac{7}{8}$ " pieces are required, each stack being  $1\frac{1}{2}$ " high when compressed tightly.

Using hand shears, round one end of each piece in two of the short and two of the long piles. One carefully shaped piece may be employed as a template for cutting the others (Fig. 3).

The holes must be accurately located and carefully drilled, as any inaccuracy here will cause difficulty in assembling the core.



6

The location of the holes should be marked in advance on the upper wood piece, and the drilling should be continued into the lower piece.

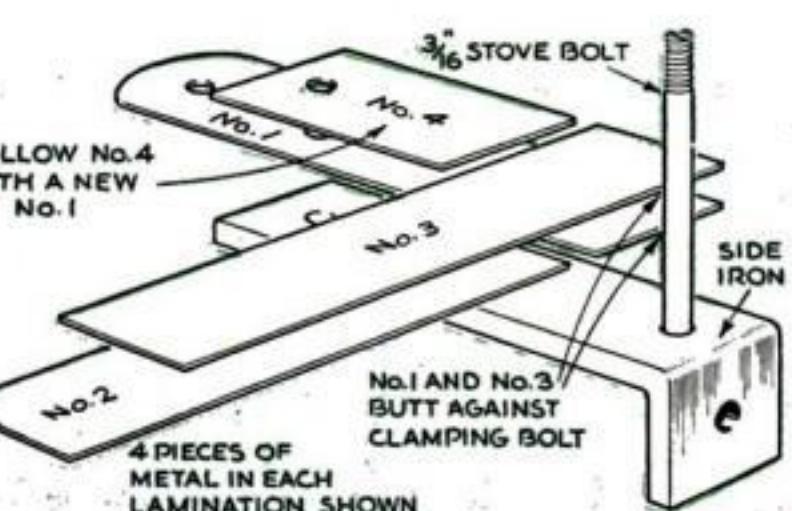
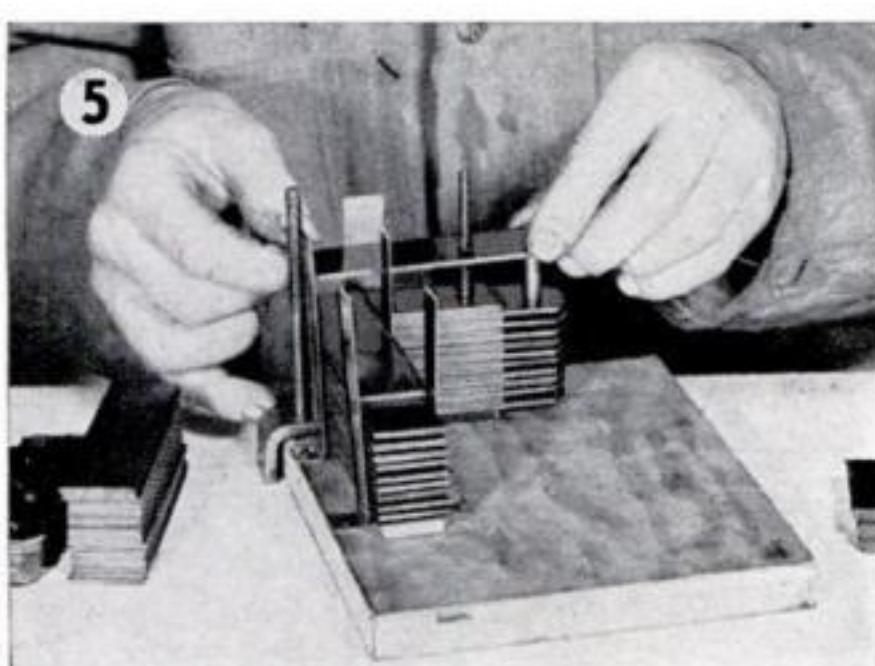
After the short pieces also have been drilled, inspect the laminations and file off any rough spots or burrs so that all the surfaces are perfectly flat. Prepare a stacking guide by laying one of the side irons, with two of the stove bolts pushed through the holes in it, on a small board so that the bolts stand upright. Holes drilled in the board for

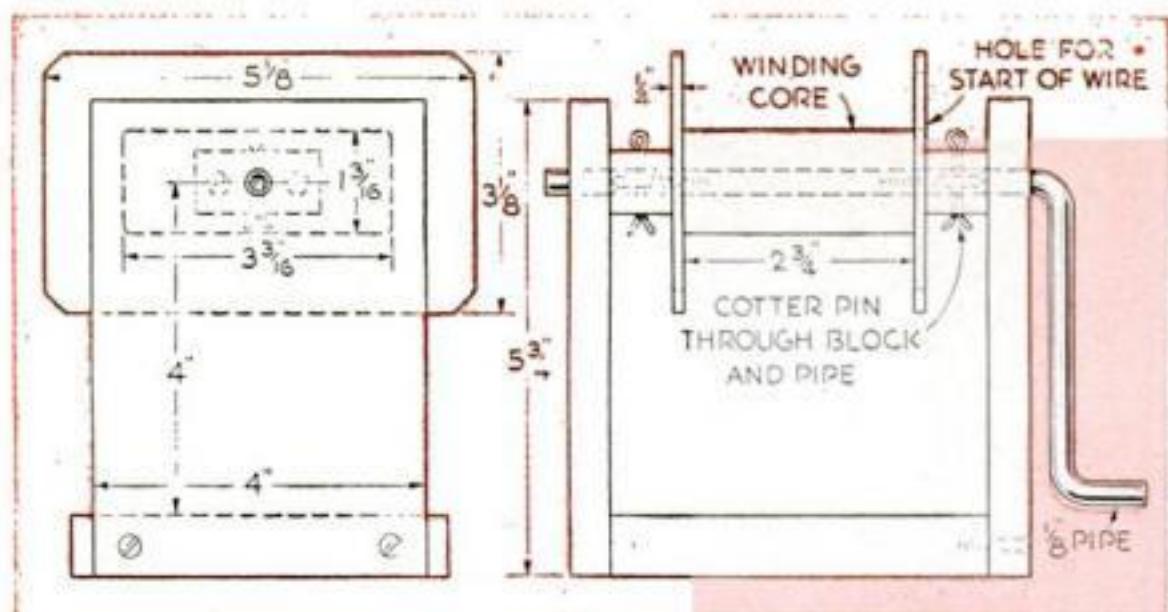
the boltheads will allow the side iron to lie flat. Tack several  $1\frac{1}{2}$ " wide sheet-metal strips in place to keep the stacked pieces aligned, as shown in Fig. 5.

Start with four of the 4" core pieces having rounded ends and two holes. Lay these pieces parallel to the side iron so that the upper bolt in the latter passes through them. Four of the undrilled long pieces are then laid at right angles to the first ones, forming a butt joint. A wood strip is placed underneath to hold these level with the others. Four identical long pieces are now laid to cover the butt joint between the first two groups, and four of the short pieces with square ends complete the first core layer. Continue stacking four pieces at a time in this way (Fig. 5), until the core is 3" high when tightly compressed; then place a second side iron on top and tighten nuts on the bolts to draw the assembly together firmly. A C-clamp may be used as an aid in making a tight stack.

Remove the clamped stack from the board and drive all joints tightly together with a hammer and a piece of  $\frac{1}{8}$ " thick flat steel (Fig. 6). Use a try-square to check the angle formed by the two legs of the core; it should be exactly 90 deg. Wind a single layer of friction tape over the open leg (shown held with a C-clamp in Fig. 6), over which the coil will fit, and lay the core aside temporarily.

Dimensions for the winding core are given in the drawings, but they should be checked against those of the actual iron core. It will save time and insure better work to make the simple winding jig shown in the drawings and in Fig. 7. Apply four layers of varnished cloth over the wooden core, then wind with No. 15 S. C. E. (single cotton, enamel) magnet wire, of which 40 turns may be laid

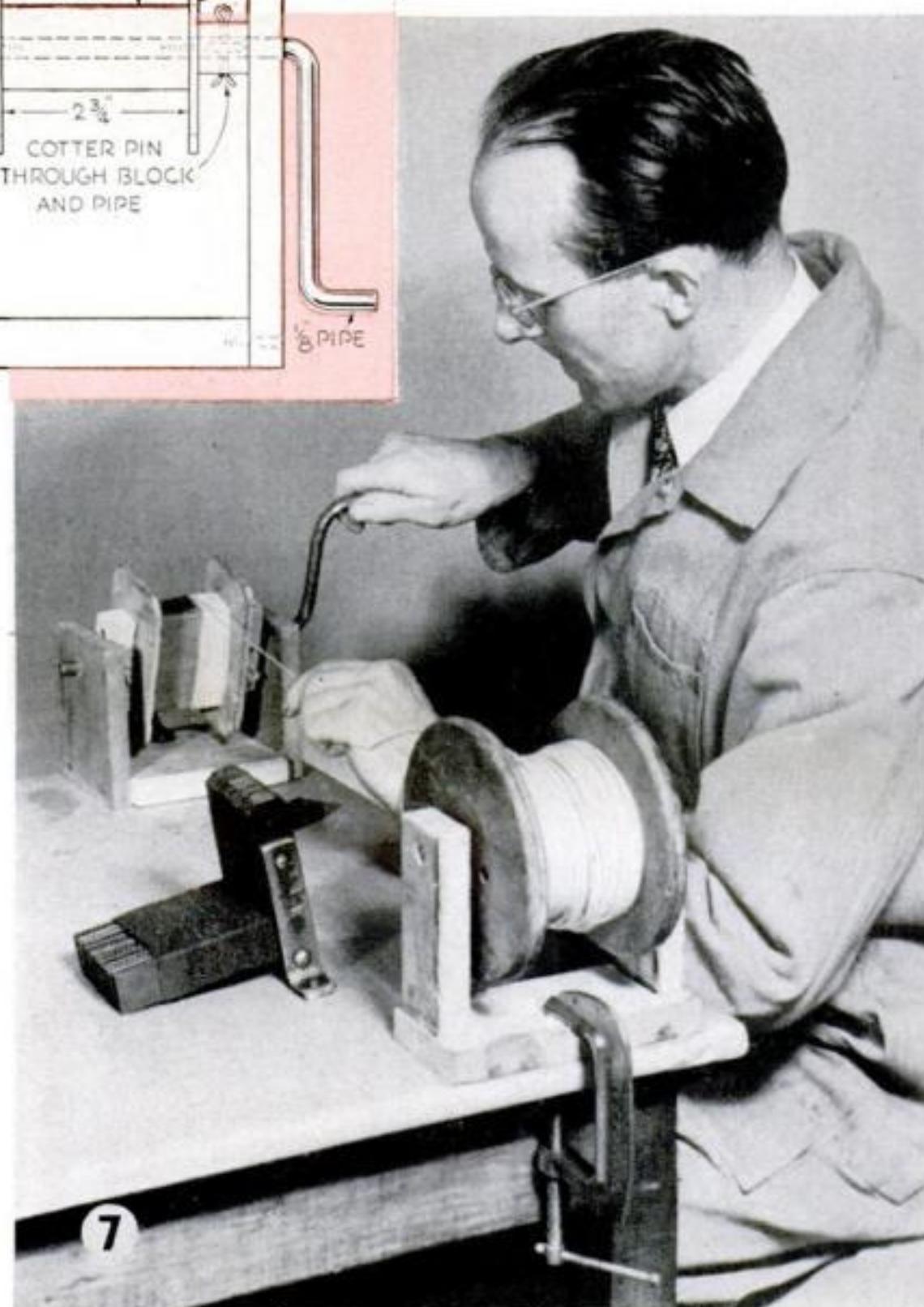


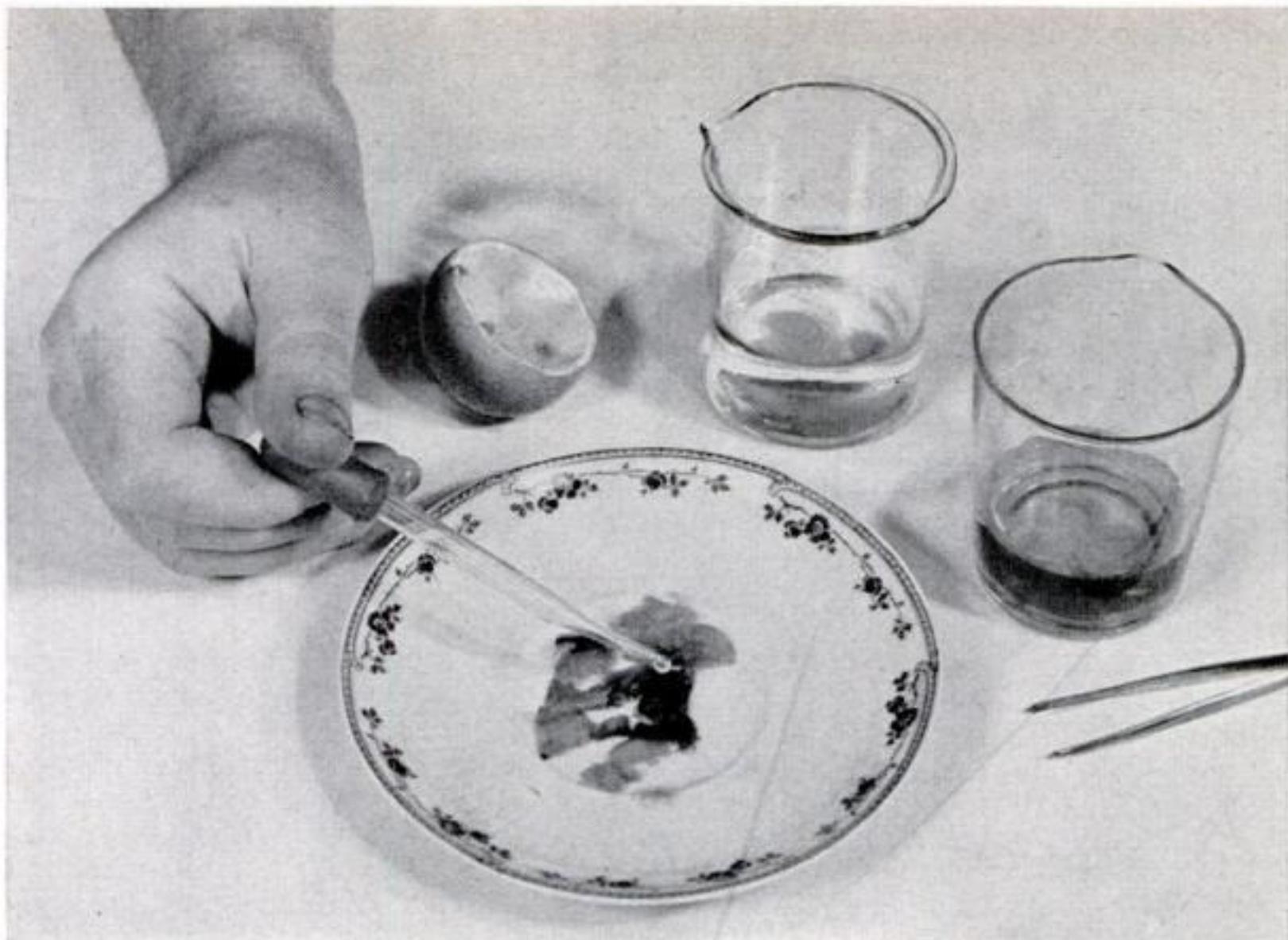


in the  $2\frac{3}{4}$ " winding space. Eight layers, or a total of 320 turns, should be wound. Brown wrapping paper may be laid between the layers for additional insulation.

When completed, the coil is carefully removed and taped so that the windings cannot open (see Fig. 8), and put on the core, leads at the bottom. The other side laminations are then woven in as in Fig. 8, first four long pieces, then four short ones, and so on, to form a solid joint with the laminations first laid. The third side iron is used under this leg of the core, and the fourth finally laid on top of it. The clamping bolts are then tightened so that the assembly is firmly secured.

(TO BE CONCLUDED)





White partitions in an orange are made of cellulose. To prove it, steep some in an iodine solution and then drop sulphuric acid on them. They turn blue-black, indicating cellulose

# Food Chemistry

SHOWN BY SIMPLE  
KITCHEN-TABLE  
EXPERIMENTS

**W**E MARVEL at the magic of modern chemistry, that changes wood pulp into artificial silk; coal tar into exquisite dyes; coal, air, and water into amazing fabrics and plastics. Yet, marvelous as these transformations may be, they are insignificant compared with the miracles that occur constantly in your own body. With all their skill, chemists still can't duplicate the complete process of digestion, assimilation, and transformation of food that occurs in the body. They have, however, learned a great deal about it. Many of their experiments may be duplicated with simple chemicals and equipment.

Food scientists classify food elements as carbohydrates, fats, proteins, and minerals. Carbohydrates serve primarily as fuel, releasing energy in the form of heat and in bodily power. Fats also provide fuel, and may be recreated in the body in the form of fatty tissue. Proteins are the substance from which the body repairs worn-out tissue and builds new. Minerals go to making bones and teeth, and also aid life processes.

Starch—a carbohydrate found abundantly in such foods as bread, grains, and po-

tatoes—is easy to detect. Put a little of the food to be tested in some water in a test tube, and cook for several minutes to break open the starch grains. After cooling, add a few drops of a dilute solution of tincture of iodine mixed with water. If starch is present, the solution will turn a deep blue-black.

Although starch probably constitutes the largest source of food, it cannot be used by the body until it is first changed into some form of sugar. Ordinarily, this change takes place in digestion. Sometimes it is wholly or partly effected by means of preparation or cooking. Cornstarch, for instance, may be changed into glucose, or grape sugar, by cooking with a dilute acid. Dextrin, which is an intermediate substance between starch and sugar, may be produced by baking starch in a dry heat. This is one reason why toast is more easily digested than untoasted bread. The starch in the surface layers has been changed largely into dextrin.

To prove this, break up a little fresh bread in water, shake it and filter. Test the liquid with iodine solution, and the blue-black starch reaction occurs. Now toast a

piece of bread and scrape off some of the very top golden-brown layer into a little water. Shake and filter, as before, and repeat the iodine test. If the starch had been changed completely to dextrin, the resulting color would be reddish. Because some starch still remains, the color will be purple.

Sugar, the other great form of carbohydrate, occurs chiefly in fruits, and in sugar cane and sugar beets. Common cane sugar must be changed into one of the less-known forms before it can be used by the body. Other sugars, such as malt sugar, grape sugar, milk sugar, fruit sugar, may be assimilated almost without change.

These sugars are known as reducing sugars, because of their ability to steal oxygen from certain chemical compounds. You may test for them by making use of this peculiarity. Your testing medium is Fehling's solution, made up of two solutions which you combine just before use. For the first solution dissolve 35 grams of copper sulphate in a little water, and then dilute with water to make a pint. Make the second solution by dissolving 173 grams of Rochelle salts in water, then adding 50 grams of sodium hydroxide. Cool this, and add water to make a total volume of a pint. To use, combine equal parts of these solutions and

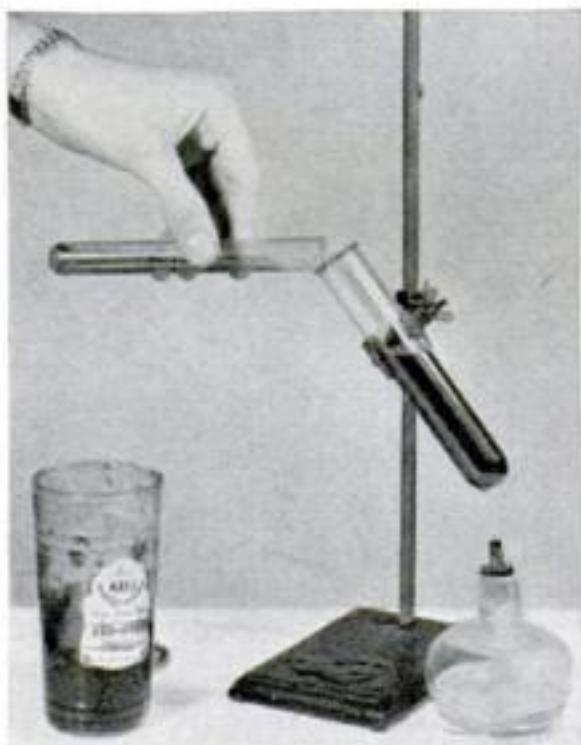
add twice as much water as their total volume.

To find out if food contains reducing sugar, boil a sample of it for a few minutes in water, filter, and add the water to a little Fehling's solution which you boil for several minutes longer. Originally blue, the solution will turn yellow, or orange or brown, if reducing sugar is present, owing to the stealing of oxygen from the copper—changing cupric hydrate to cuprous hydrate, which is precipitated.

When Mother makes jams and preserves, combining sugar with acid fruits, an interesting reaction occurs which may be proved

by the same test. During the process of cooking the fruit with the sugar, part of the cane sugar remains as cane sugar and part is changed into "invert" sugar, a combination of grape and fruit sugars. It is to produce this reaction that lemon juice or tartaric acid is often added to jams made of material containing little acid. By mixing a little jam with water, and testing as before, the invert sugar may be discovered.

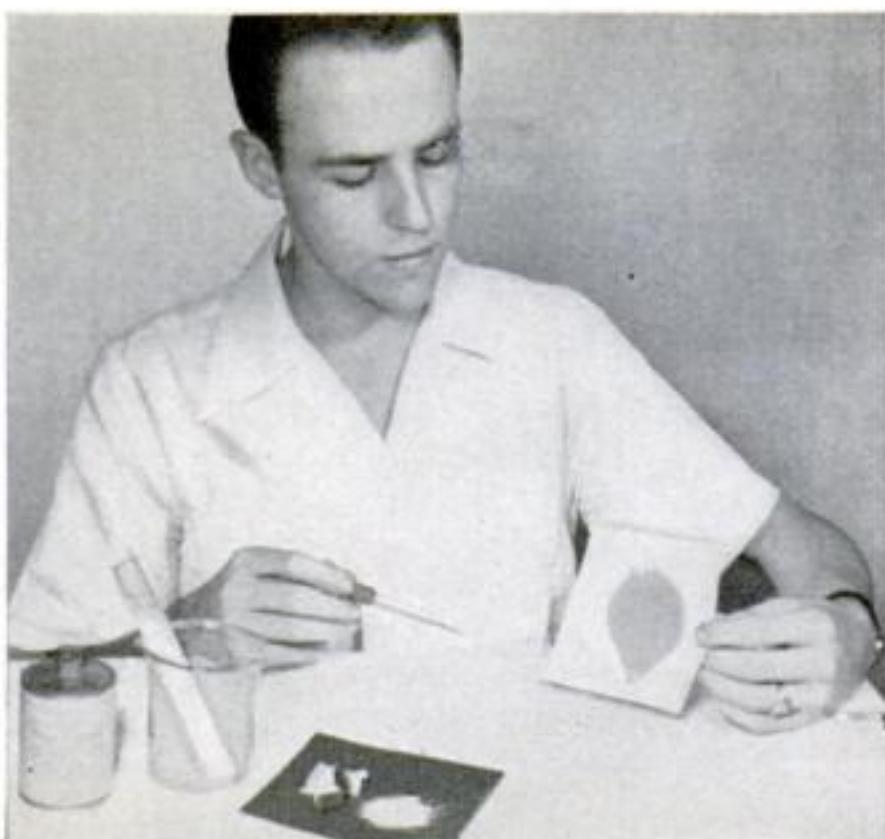
Cellulose, which makes up the cell walls and fibrous portions of plants, is a carbohydrate which helps clean out the body by providing roughage, but which cannot be digested by man



A test with Fehling's solution shows that some of the cane sugar in jam has been changed into "invert sugar"



To show how ptyalin in saliva changes starch into malt sugar, samples of starch-and-saliva mixture taken at 20-second intervals are applied to successive drops of iodine test solution on a plate



The grease-spot test for fats. Shake a little of the food to be tested with ether and put a few drops of the solution on glazed paper. If fat was present, a grease spot will be left on the paper

and converted into fuel. Strangely enough, its chemical formula is exactly the same as that of starch. To test for it, cut out the white partitions in an orange or lemon and scrape them clean of pulp. Steep the partitions in an iodine solution, and then drop strong sulphuric acid on them. The resulting purple-blue color indicates cellulose.

Fats in foods may be easily detected by means of the familiar grease-spot test. Shake a little of the food—mashed up, if it is a solid—in a few cubic centimeters of ether, which readily dissolves fats. Pour some of the ether on a sheet of thin paper. If fat is present, a grease spot remains after evaporation.

Without proteins we should soon die, as neither fats nor carbohydrates contain nitrogen, which is an essential element in body construction. That protein contains nitrogen may be quickly determined. Heat some dry soda lime in a test tube with a substance containing protein, such as chopped boiled white of egg. Ammonia gas—which is a combination of nitrogen and hydrogen—will be given off. Food may be tested for protein by heating a little of it with strong nitric acid. If protein is present, the food turns yellow.

Digestion itself may be demonstrated vividly with the aid of only a little starch, saliva, and the iodine test. Think of a nice juicy lemon, and transfer the saliva that collects in your mouth to a test tube, until the tube is a quarter full. Then add as much water, and stand the tube in a water bath heated to about 38 degrees C.

Mix a few grains of corn starch with half a test tube of boiling water, and boil about five minutes. Cool, and place also in water bath. On a plate, place a number of separate drops of iodine solution.

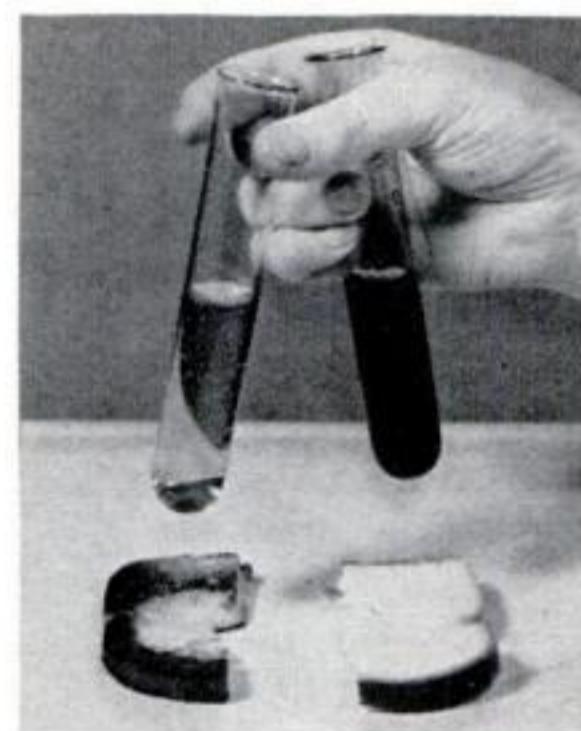
When both saliva and starch are at temperature of water bath, put about 20 drops of saliva into the tube containing starch. Immediately take out a drop of the mixture



Protein contains nitrogen. To prove it, heat some dry soda lime in a test tube with chopped boiled white of egg. Ammonia gas, which is a combination of nitrogen and hydrogen, will be given off at once

Tests show that some starch in toasted bread has been changed to dextrin, while fresh bread gives the pure starch reaction

Salts of heavy metals precipitate proteins from solution, explaining why white of egg is an antidote for metal-salt poisons

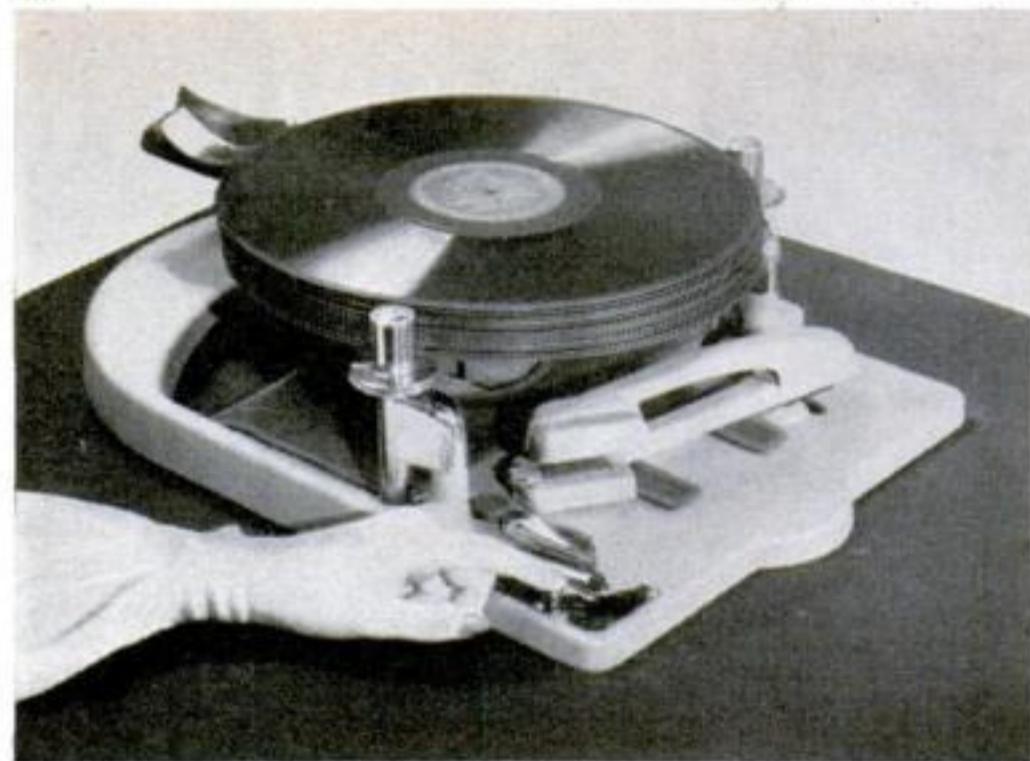


and add to one of the iodine drops. Deep blue, indicating starch, appears. Now dip out drops about every 20 seconds, adding them to successive drops of iodine. Each drop gives a reaction of different color—ranging from blue-black through purple, mahogany, red, to no color at all.

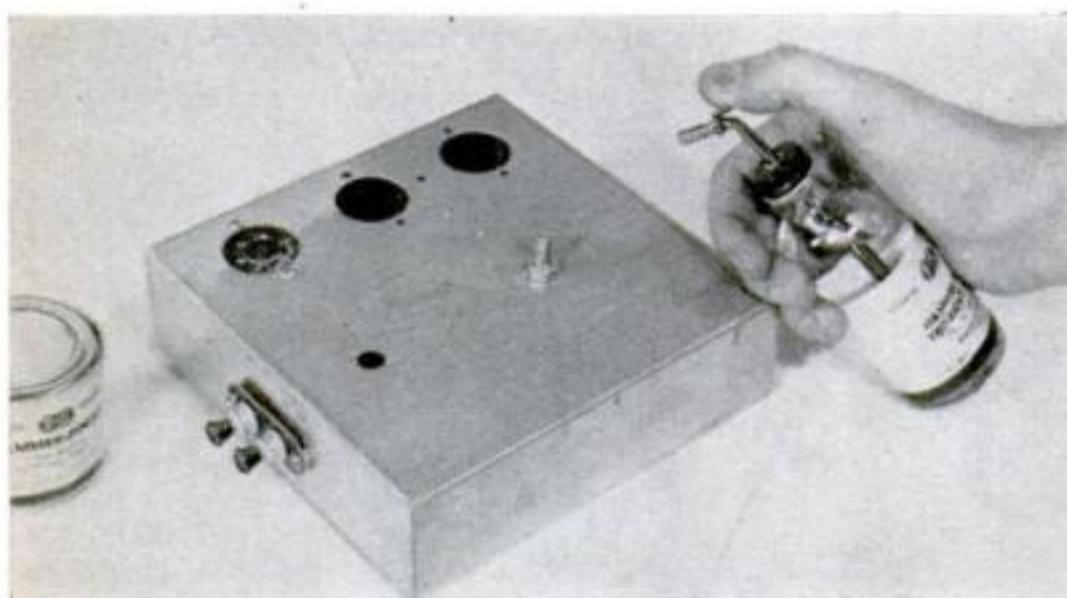
The reason? The enzyme ptyalin, in the saliva, initiates the process of starch digestion. Beginning as pure starch, the substance gradually changes to dextrin, and then finally to maltose. The latter may be detected with Fehling's solution.

# Radio Ideas

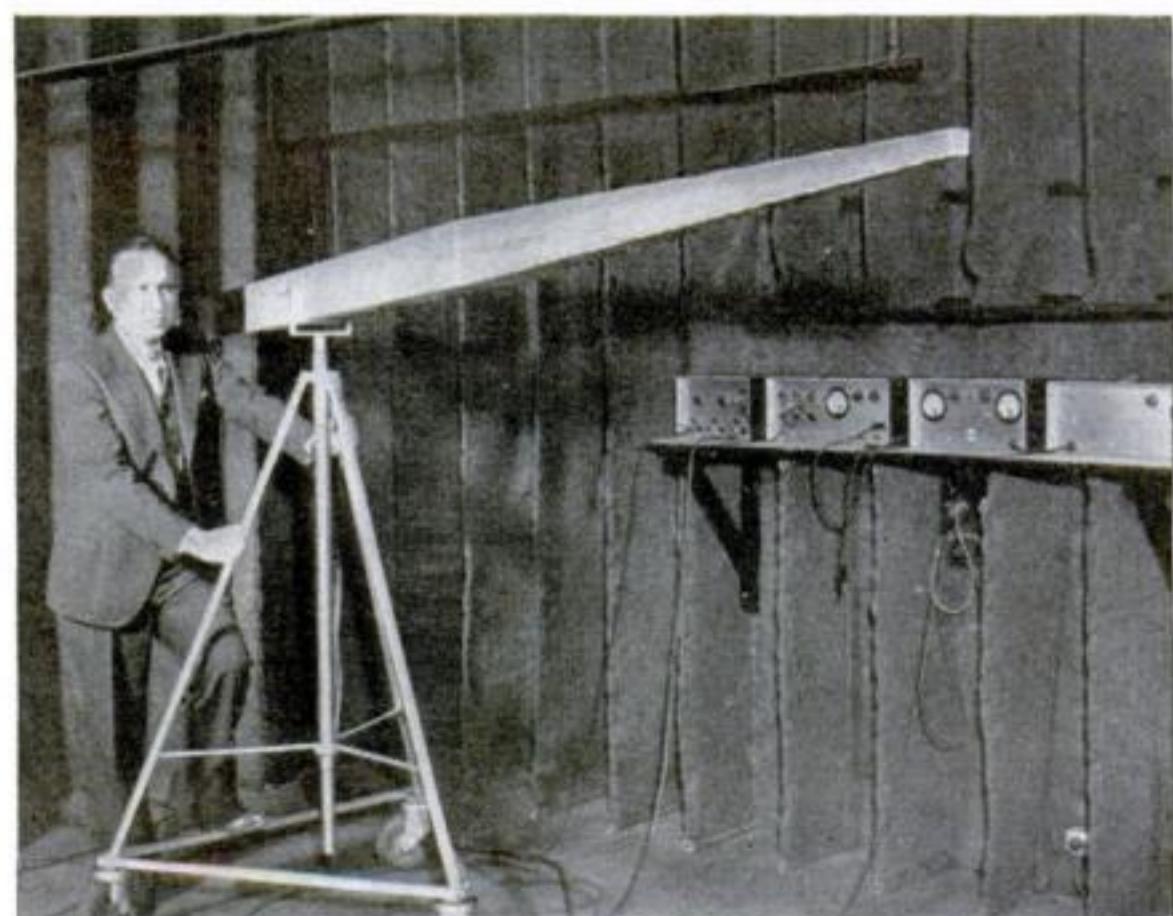
A TANDEM PICK-UP ARM, which plays both sides of a phonograph record without turning it over, is the feature of a new automatic record changer. After the starting button is pressed, the new instrument will provide as much as two hours of uninterrupted music. Formed of one arm and two pick-ups, the device plays first the top side, then the bottom side, of each record in turn. After reaching the end of the upper side of the record, the arm swings clear of the disk while the direction of the turntable is reversed. Rising, it then makes contact with the under side of the record. When both sides have been played, the arm again



swings away while the disk descends into a felt-lined compartment below. Another record, from the bottom of the pile above the arm, drops into place and the procedure is repeated. A record may be rejected while playing by pushing the starting button.

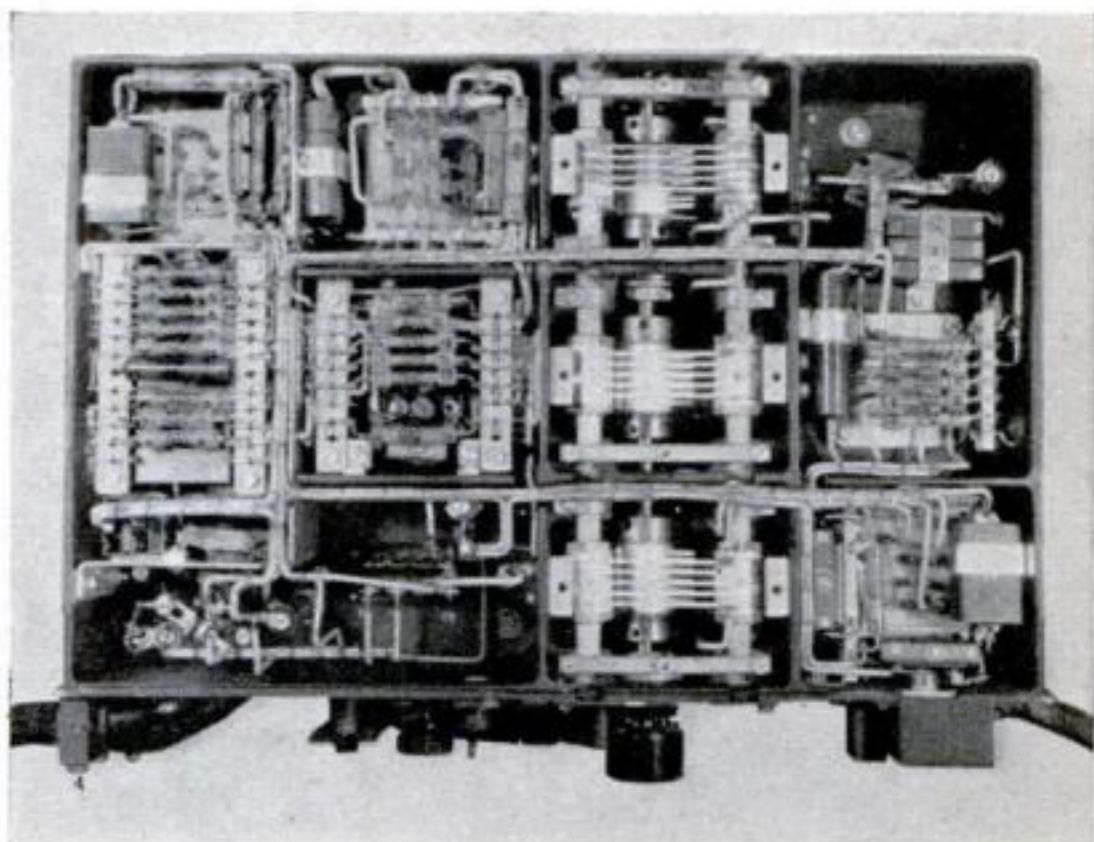


LONG-DISTANCE RECORDING for radio, television, and movies is made possible by a new "line microphone." Appearing at first glance like a telescope mounted on a wheeled tripod, it is ten feet long and consists of a series of quarter-inch pipes encased in a perforated metal sleeve. The perforations are pick-up points for sound waves, which are carried through the pipes to a ribbon transducer where they are changed into electrical impulses. Unlike the conventional microphone, it is highly directional, and can pick up such sounds as the music of an orchestra at a distance of 100 feet.





**MESSERSCHMITT RADIO EQUIPMENT**, obtained from a Nazi fighter plane shot down in England, has been examined carefully by American engineers. They have found the receiver, shown at right, lacking in many of the improvements standard on American equipment. In forming the tube sockets, terminal boards, and coil forms of the set, the German designers used ceramics instead of plastics. The various leads used in the wiring were covered with varnished cambric tubing. When special sub-assemblies were fastened by means of screws, the screws were locked in place by means of cement instead of lock washers.



**CORNER-POST ANTENNAS** for automobiles have been designed as an aid to safer driving. By attaching the antenna at the corner of the car, the possibility of interfering with the sight of the driver is eliminated. The new-type antennas are curved to conform to modern streamlined design and are heavily chrome-plated. Supplied with each antenna is a weatherproofed shielded lead-in cable and a bayonet adapter for plugging into the antenna post on the car's radio.

**MIDGET TUBES** recently developed primarily for use on the ultra-high-frequency bands also work satisfactorily on the broadcast band, making possible compact three and four-tube receivers. They have an overall height of  $1\frac{3}{4}$  inches and a diameter of only  $\frac{3}{4}$  inches. The tubes are of all-glass construction, with a seven-prong glass button base. Heater voltage rating is 6.3 volts A.C. or D.C. at .15 amperes.

# You Can Build— FM RECEIVER FOR \$22

By ARTHUR C. MILLER

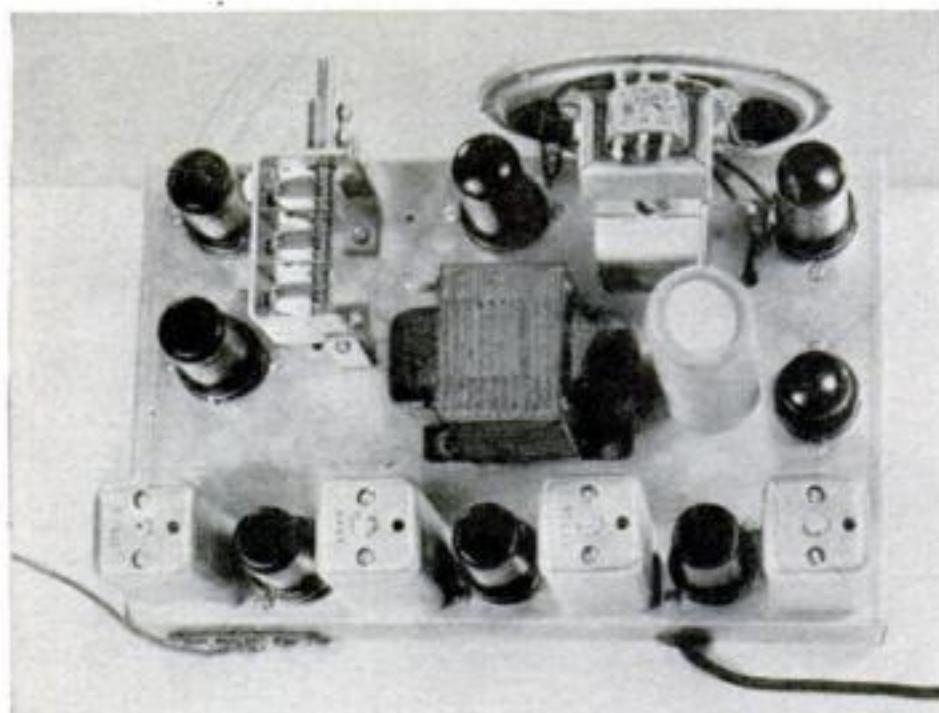
**T**HIS unit is not just another FM converter, but a complete eight-tube FM receiver, and it can be built for only \$22. Extremely compact, it is mounted in a cabinet usually sold for four-tube receivers.

A simplified version of the original FM circuit is used, a circuit so rapidly becoming standard that a kit of low-cost components has been put on the market. These parts, used in this design, are a set of three FM coils (antenna, RF, and oscillator), three special FM I.F. transformers peaked at 4,300 kilocycles, a discriminator transformer, also peaked at 4,300 kilocycles, and a three-gang tuning condenser, each section having a capacity of 7-22 mmfd.

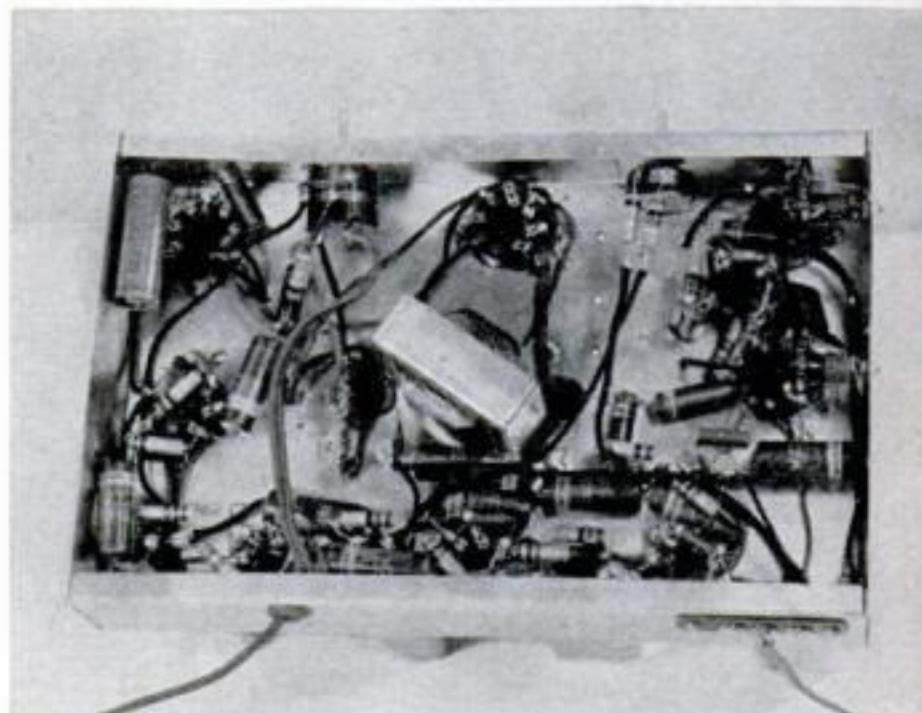
The main difference between a standard broadcast superhet and an FM superhet is the use of a limiter tube and a "discriminator" stage. Otherwise this FM receiver consists of the usual R.F. stage (converter stage) and two I.F. stages (second detector and audio stage). The "discriminator" stage makes possible the detection of FM impulses and discriminates against standard or amplitude-modulated impulses.

In an FM receiver all grid and plate leads must be as short as possible, especially in the RF and converter stages. The layout here allows short leads between the tube prongs, condensers, coils, etc. The 10,000-ohm, 1-watt loading resistors across the secondary windings of the coils stabilize and balance the I.F. circuits. An elaborate decoupling system in each plate and screen lead of the first five tubes eliminates feedback between the circuits which would cause oscillation. The rectifier tube and circuit deliver 250 volts at about 60 milliamperes.

Front panel of the FM receiver described in this article



Top view of chassis, showing the compact layout of tubes, transformers, condensers, and speaker, which permits installation in a small, four-tube cabinet



Bottom of chassis. Note filter choke in center and the special FM coils on extreme right. A phone jack indicated in diagram is not shown

It is difficult to align an FM receiver, and a dependable dealer will do it for you. Those who are ambitious, however, and can obtain a signal generator can do it at home. Align the discriminator transformer by applying a signal of 4,300 kilocycles to the grid of the 6SJ7 and connecting an O-1 ma. meter with a 100,000-ohm resistor in series with the meter across the 6H6 cathode. Adjust the secondary trimmer of the discriminator until a movement of the meter's needle is noted. As the trimmer is tuned, the meter will go plus or minus, either side of the resonant frequency. Set the trimmer so the meter reads zero voltage. The primary trimmer of the discriminator transformer is adjusted to the maximum reading when it is connected between the center tap of the transformer and ground.

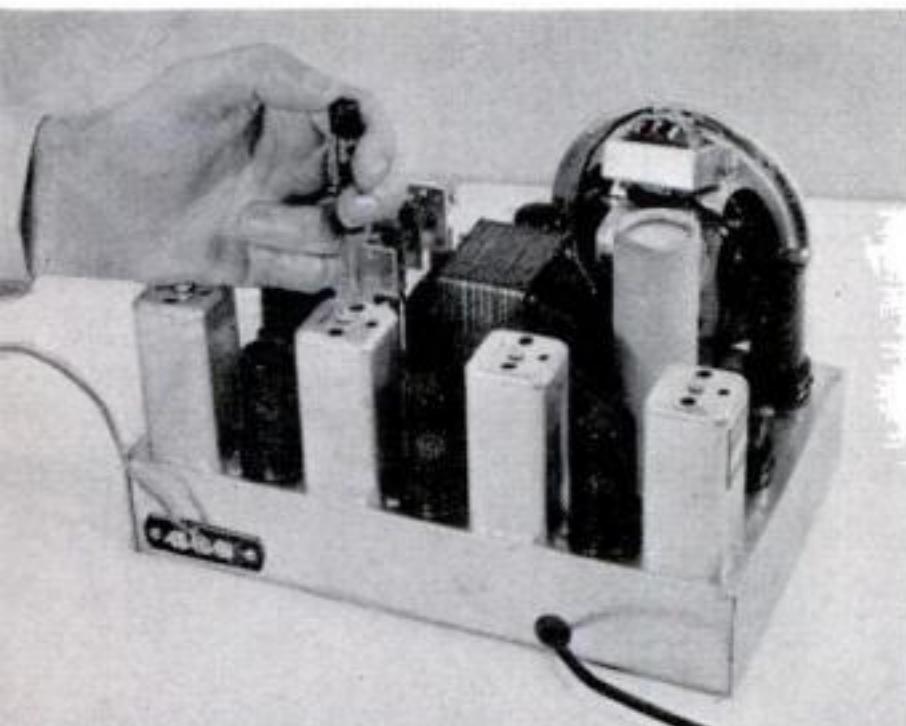
To align the I.F.'s the same O-1 ma. is connected in series with the grounded side of the 50,000-ohm variable resistor (sensitivity control). By-pass the meter with a .02-mfd condenser, and apply a 4,300-kilohertz signal to the grid of the preceding 6SK7. Tune the transformer for a maximum reading on the meter. Apply a signal to the next 6SK7 and repeat the procedure. To align the trimmer condensers on the three-gang tuning condenser, tune in a station and adjust each trimmer, by ear, until the station is received at maximum volume.

Adjusting the trimmer condensers. The steel cabinet has a hinged lid

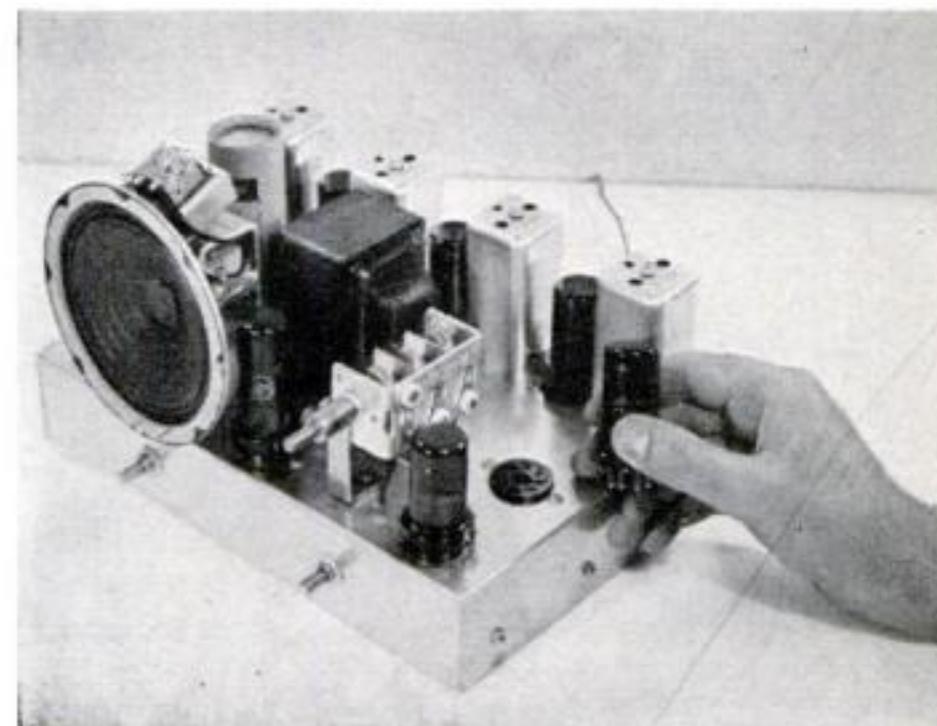
If the set is located within ten to 15 miles of an FM broadcasting station, a short piece of wire (about ten feet) connected to point "b" on the antenna binding post will suffice, but for best results a special doublet FM antenna should be connected to "a" and "c" on the binding post.

There are two important points about FM reception to keep in mind. First, the discriminator stage will not operate satisfactorily unless a sufficiently strong signal reaches the grid of the 6SJ7. Secondly, the range of FM is limited to about 50 miles.

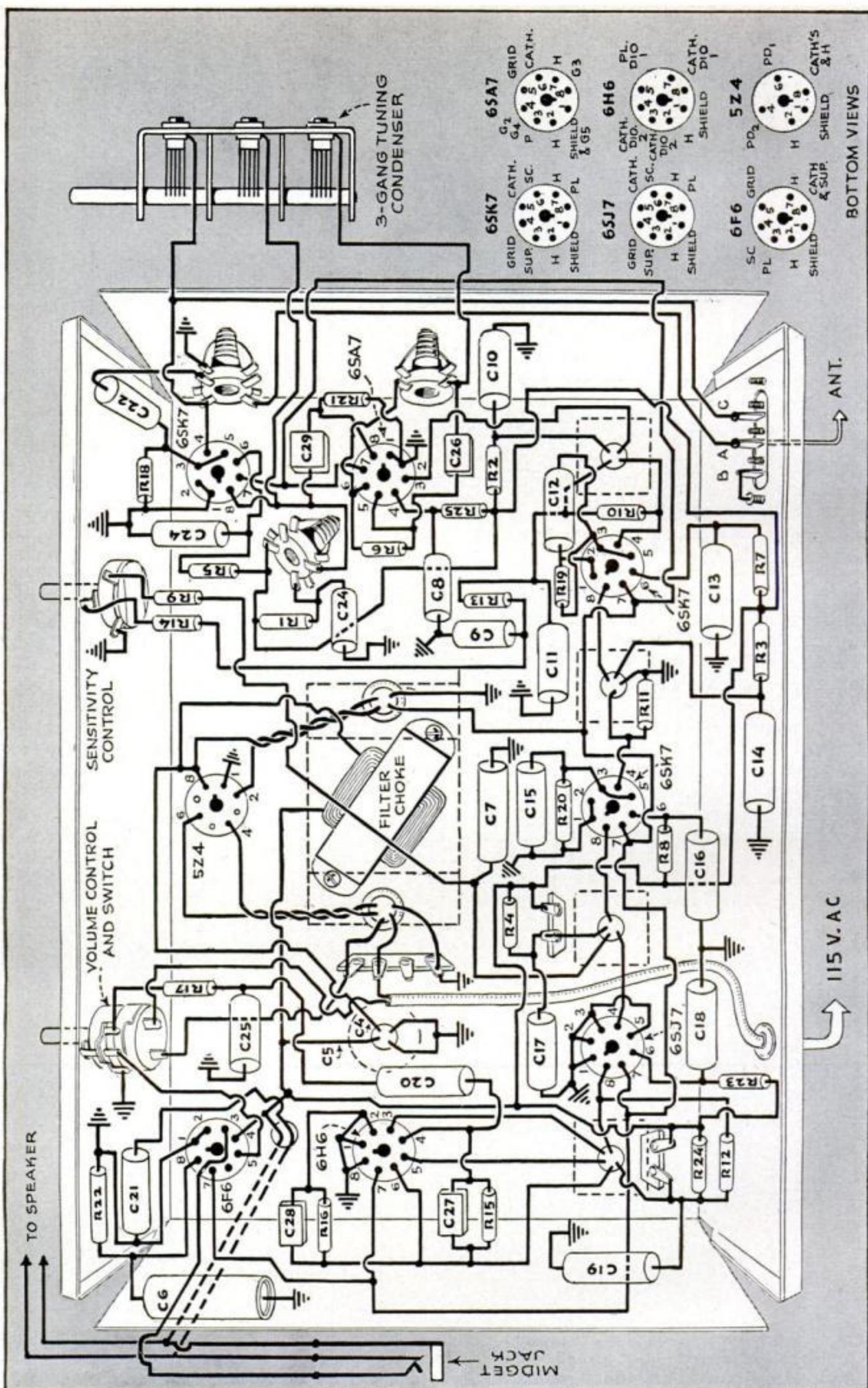
The five-inch permanent magnet speaker does not do justice to high-fidelity FM reception. It is better to buy one of the high-fidelity speakers now sold for FM reception and use the small speaker just for speech or for monitoring the reception.



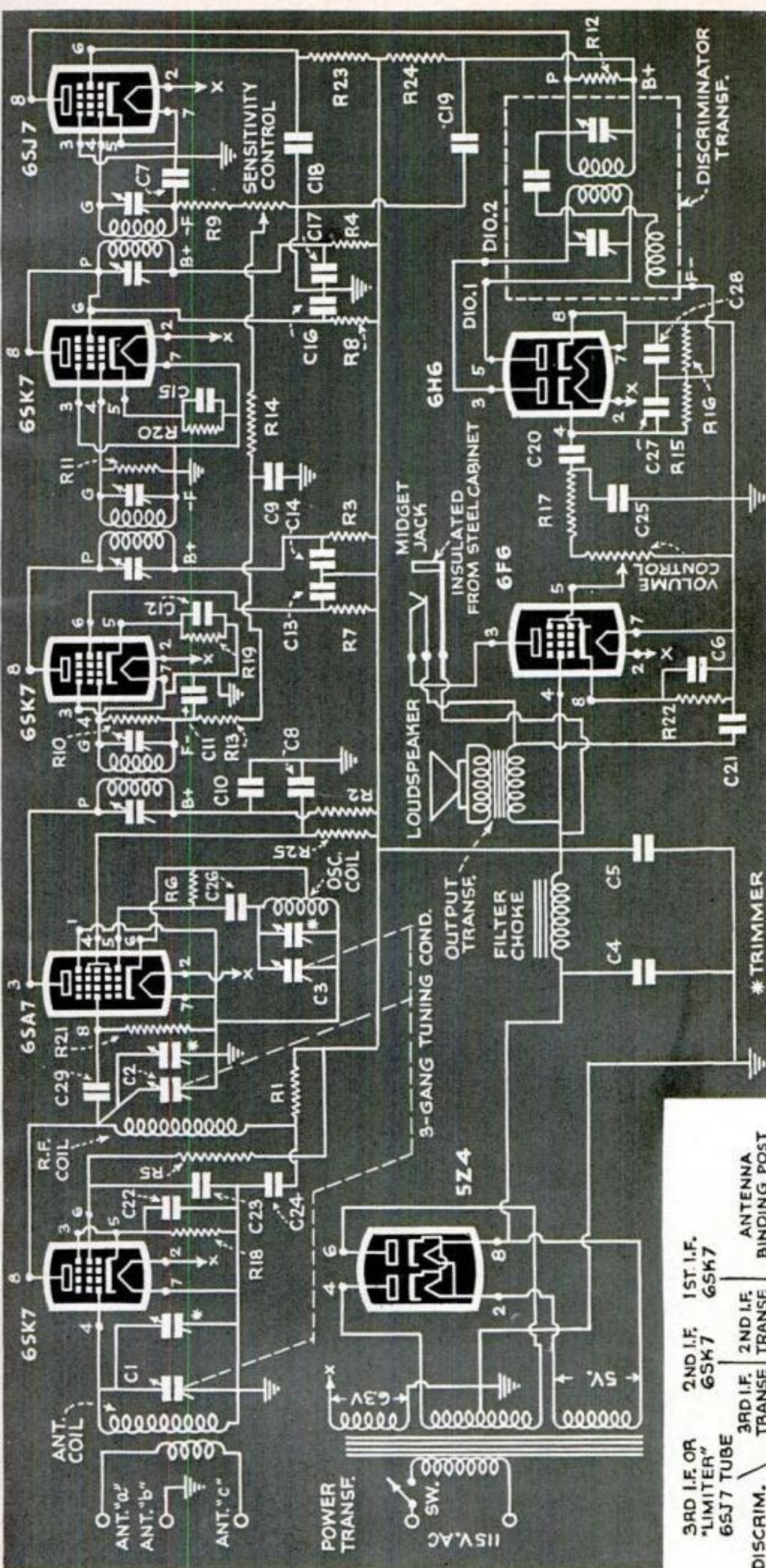
Making final adjustments. Since the tubes and power transformer generate heat, two four-inch ventilation holes should be cut in cabinet's back



View of the RF portion of the FM chassis, showing the three-gang tuning condenser, the 6SK7 RF tube at front, and the 6SA7 mixer tube held in the hand



The diagrams above and on the facing page make it easy to follow the wiring connections. Above, lower right corner, are bottom views of tubes in the layout



Transformers: output; power, 680CT-70, 5 volts-2 amp. 6.3-2.5 amp.; discriminator, 4,300 kc.; (3) FM I.F., 4,300 kc.

Filter choke, 11 henrys, 300 ohms.

Variable resistors (2); 50,000 ohms; with switch, 500,000.

**Speaker; octal sockets; steel chassis; cabinet; tubes, etc.**

mfd., C26 to C28; .004, C29.  
 Carbon resistors: (4) 1,500  
 ohms, 1 watt, R1 to R4; (5)  
 50,000, 1, R5 to R9; (3) 10,-  
 000, 1, R10 to R12; (5) 100,-  
 000, 1, R13 to R17; (3) 150,  
 1, R18 to R20; 250,000, 1,  
 R21; 400, 2, R22; 75,000, 1,  
 R23; (2) 20,000, 1, R24-R25.  
**FM coils; antenna; RF; oscillator.**

3-gang tuning condenser, 7-22  
 mmfd., C1 to 3.  
 Electrolytic condensers: dual  
 8-16 mfd., 25 volts, C4-C5;  
 50, 25, C6.  
 Tubular condensers: .1 mfd.,  
 400 volts, C7; (2) .01, 400,  
 C8-C9; (11) .05, 400, C10 to  
 C20; .006, 600, C21; (4) .001,  
 600, C22 to C25.  
**Mica condensers: (3) .00005**



# Good Portraits Must Be Planned

*"There's no such thing as a lucky shot," says Pirie MacDonald in an interview with Popular Science*

**P**IRIE MACDONALD, world-famous portrait photographer, has given most of his life to the art of making human portraits of human beings.

He is devoted to that art. He values it and respects it. He takes an artist's and a craftsman's pride in his work, and a deep satisfaction in the results of that work. And if there is one word he hates and despises in connection with his work, that word is "luck."

MacDonald says simply that luck has nothing whatever to do with the making of a really fine portrait. To make one you must know what you want to do, and know how to do it; then you go ahead and do it. The element of luck or chance doesn't come into the process at all.

Pirie MacDonald is in his seventy-fifth year now, and 58 of those years have been dedicated solely to the professional practice of photography. He is a tall, spare, tempestuous man, with a sizable streak of Scottish reserve until he gets excited about something.

Then he will stride around his studio on New York's Fifth Avenue, his cheeks growing pinker and pinker, his crisp, iron-gray hair seeming to bristle—even the ends of his neatly trimmed mustache appear to point due north a bit more sharply. And as good a way as any to get him excited is to raise the subject of luck in portrait photography.

"When you talk about photographic portraits—really good ones—there is no such thing as a 'lucky shot.' That phrase is anathema to me," he will tell you. "The man who talks about a lucky shot in making portraits is simply offering his confession that he didn't expect to make a good picture when he started. He is trusting that some accident of good fortune will make up for his own lack of serious purpose and workmanlike intention. There is no luck in a good portrait at all. A good portrait is pre-

Pirie MacDonald, a self-portrait, at left. For four decades he has concentrated on the portrait photography of men, and his work has acquired an international reputation. To put aside the temptation to glamorize, he resolved never to photograph a woman again. He has stuck doggedly to that determination.



MacDonald's portrait of the poet, John Masefield

conceived; it is premeditated; it is planned."

MacDonald's reputation as a portraitist is national and even international. His work has been so widely exhibited and even more widely reproduced that many of his pictures are familiar to those who know little of the art of photography. Professional photographers and laymen alike look upon him as a man who has attained an ambition while concentrating for four decades on his chosen field—the portrait photography of men subjects. For years his advertisements have identified him: "Pirie MacDonald, Photographer of Men."

His early career, however, is not so well known. One fact that invariably amazes MacDonald's friends is that he left school at the age of 11 years, and has never had any formal education since then. Constant reading and study, plus a passion for travel, have given him a broad cultural background. Word roots are a special enthusiasm which he gratifies; for many years he has never gone to bed without a dictionary on the night table at his side.

*(Continued)*

His first job was that of handy boy in an iron foundry in Troy, N. Y. While still in his early teens, he became interested in the then young profession of photography, and when he was 17 years old he got his big chance to start work as apprentice in the local photographer's studio. His pay was only \$4 a week, and his apprenticeship lasted for seven years. By then he felt that he knew his craft. Furthermore, through economies remarkable even for a lad of Scottish extraction, he had accumulated \$75 with which he contrived to open his own studio in nearby Albany.

Photographers were still using wet plates when he broke in—they were mixing their chemicals and sensitizing their plates just before they were to be exposed. MacDonald recalls his first and only master as a regular giant of a man (he was descended from an old whaling family in Stonington, Conn.), a man of vast dignity and inflexible standards.

"He was a man of principle," MacDonald muses, "but like so many of the pioneers, he was devoted solely to the idea of making perfect technical records, and gave no thought to the element of human character

in photography. I think the event that really started me on my own path occurred one day when a farm woman came into our shop with some proofs of pictures we had made of her husband.

"She wasn't satisfied, and when she tried to explain why, all she could say was, 'He doesn't look out of the pictures the way he looks at me.' After our chief heard about it, he took the proofs, peered at them intently, and finally said, 'They're all perfectly sharp; he didn't move.' And that was all! One of his assistants made some more pictures at a later sitting and the woman finally got something that appeared to satisfy her.

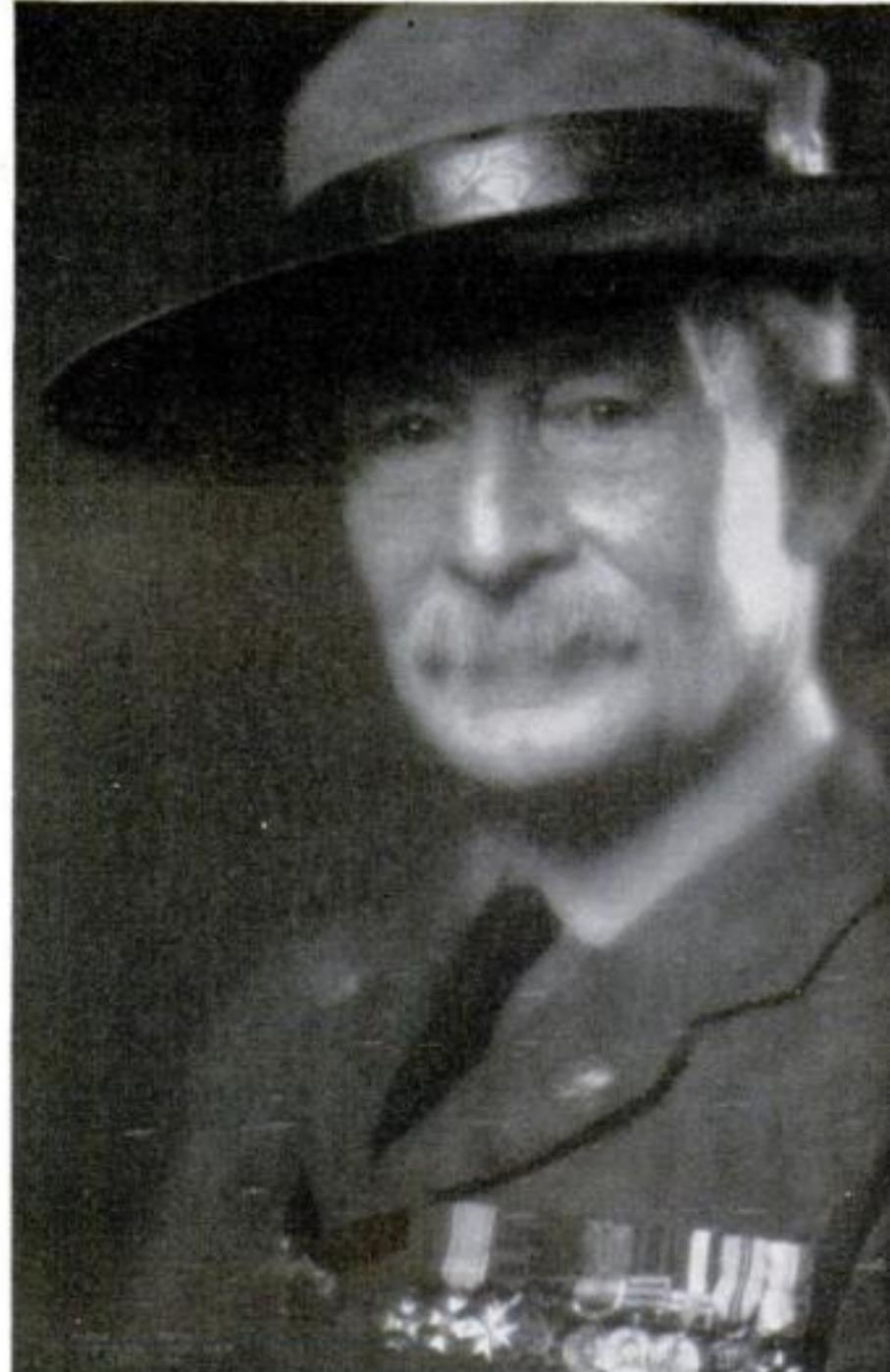
"But I couldn't forget what she said: 'John doesn't look out of the pictures the way he looks at me.' That set me on the right track. It's not an easy thing to explain, but I believe that to make a true portrait you must try to analyze and understand your subject's character, and deliberately aim to reflect that character in the picture. The essence of the whole process is the human being you are trying to portray."

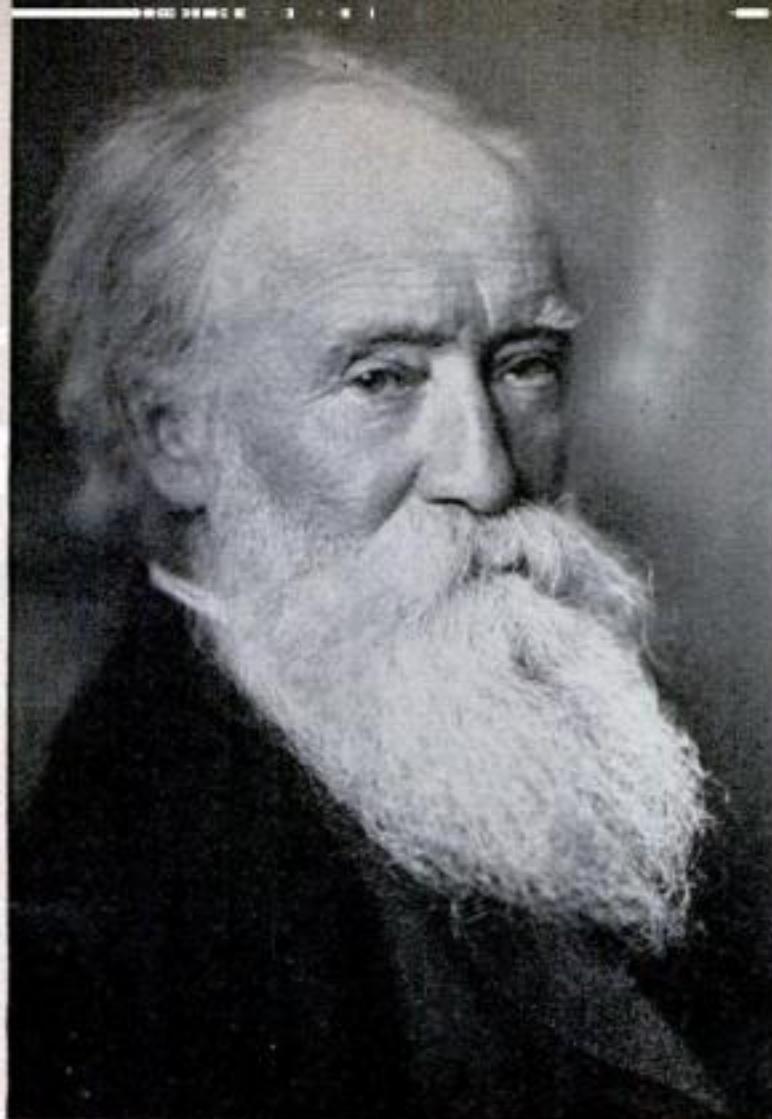
In thus stressing character study, Mac-

Theodore Roosevelt—his wife's favorite photograph



Lord Robert Baden-Powell, Boy Scouts founder





Pirie MacDonald's study of the famous American naturalist, John Burroughs

Donald does not imply or excuse any neglect of photographic technique, which he regards as basic and essential—the learned method which enables you to carry out your plan. On the subject of techniques, however, he refuses to be dogmatic. Technique is individual rather than general, he explains, and each man must learn and develop his own by experience.

On the question of lighting, for example, MacDonald will tell you that the human head has a definite structure, and the modeling of that structure in a photograph is a very precise and subtle problem. Each photographer must work out that problem for each subject; but for himself, MacDonald is convinced that the construction of the head does not permit effective use of light from below. Back lighting has some uses, he thinks, but it can be greatly overdone, and the kind of back lighting that puts a halo or aura around the head is sentimental, untrue, and absurd.

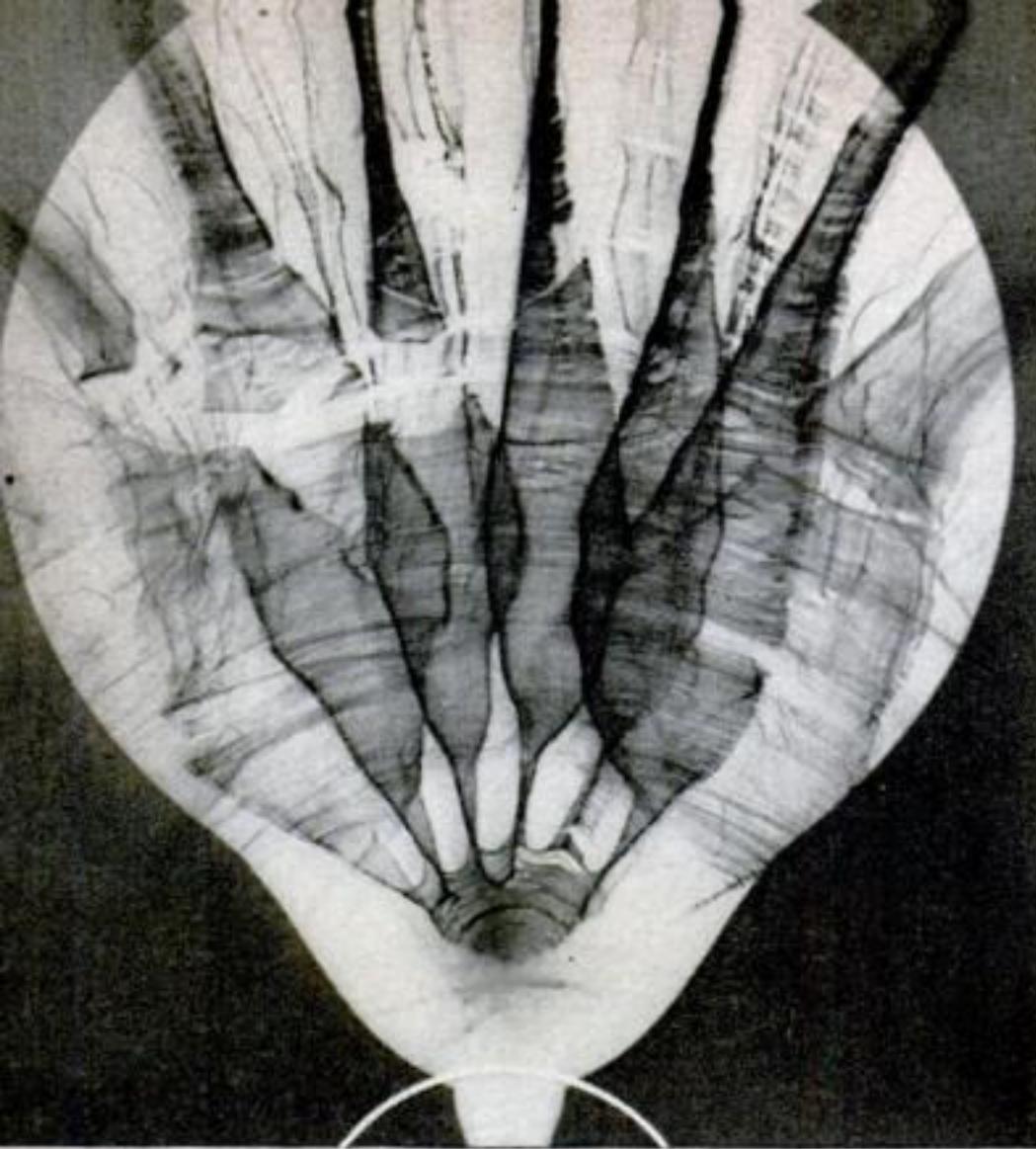
MacDonald's refusal to make portraits of women is not the reaction of a woman hater or any other type of misanthrope. He adopted the policy when he first came to New York—that was 40 years ago—and he did it to protect a principle. (He has stuck to it so strictly, by the way, that he has not made even one photograph of his wife or his daughter, and he loves them with the utmost depth of affection.)



Portrait of Arnold Bennett, who wrote many great novels

This is how he came to make his decision. When MacDonald moved to New York he already had an established reputation, and in addition to that he had the determination to do nothing but absolutely honest work. He looked with hatred on glamorizing or prettifying a subject, and from experience he knew what difficulties and disappointments lay in his path if he were to attempt to do successful portraits of women—he had learned that they usually demanded idealized photographs rather than the character studies that he wanted to do. He also knew what a temptation it was to a photographer to take a short cut to success and affluence by the glamorizing route. His decision put that temptation definitely and permanently out of reach.

With that he adds one word to his maxim that good portraits must be planned. Portraits, he says, must be planned, and planned honestly.



The image at the left is not the product of a high-power microscope, but merely the "photogram" cast on a piece of contact printing paper by a goblet. In this case the light was held at a 60-deg. angle

Various positions of the flash lights are tried to get the best distribution of lights and shadows



## Fantastic Photo Patterns Without a Camera

FANTASTIC and beautiful "photograms"—shadow pictures caught on photographic printing paper without the use of a camera—may be easily made of glassware and other common household objects with the help of one or more ordinary flash lights. Glass gives particularly striking patterns because of its capacity for catching and reflecting light, but any small articles with sharp detail may be used to produce strange designs drawn by light.

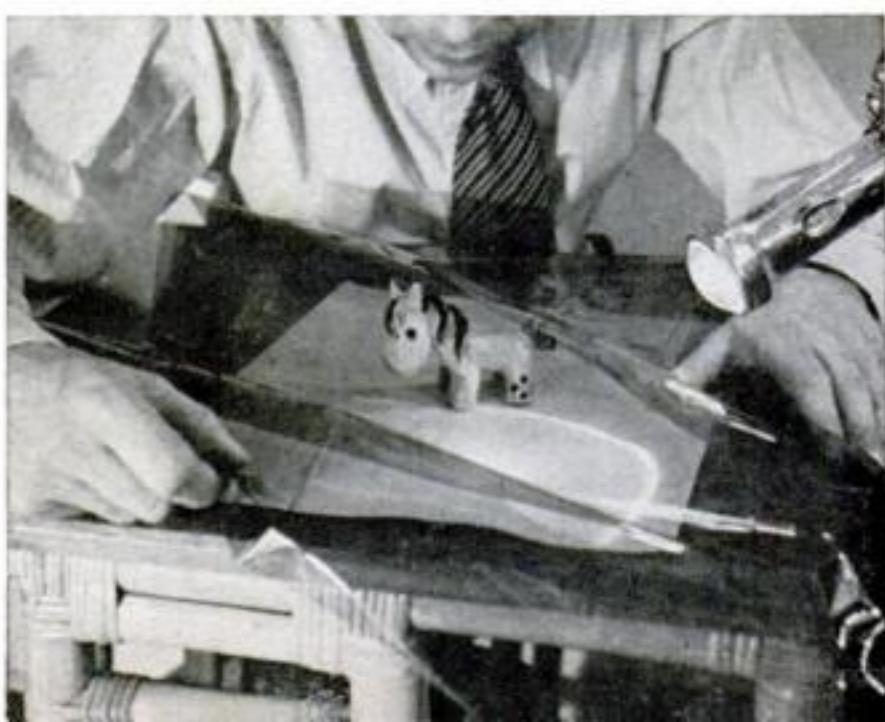
The object to be "photogrammed" is placed on a sheet of contact printing paper, which

is first covered with a sheet of orange or yellow cellulose tissue to prevent premature exposure. Room lighting must be dim. Draw the shades or, at night, put paper bags over the lamps. The flash lights, aimed from different angles, are then maneuvered over the object to produce an interesting pattern of shadow and light. Adjustment of the flash lights may be simplified by mounting them on regular photo-flood lighting stands, and shadows are cleanest when the source of light is adjusted as nearly as possible to a point.

Exposure is made merely by removing the colored tissue and allowing the light to register on the paper. With ordinary flash lights and paper, exposure may run from one to ten seconds.

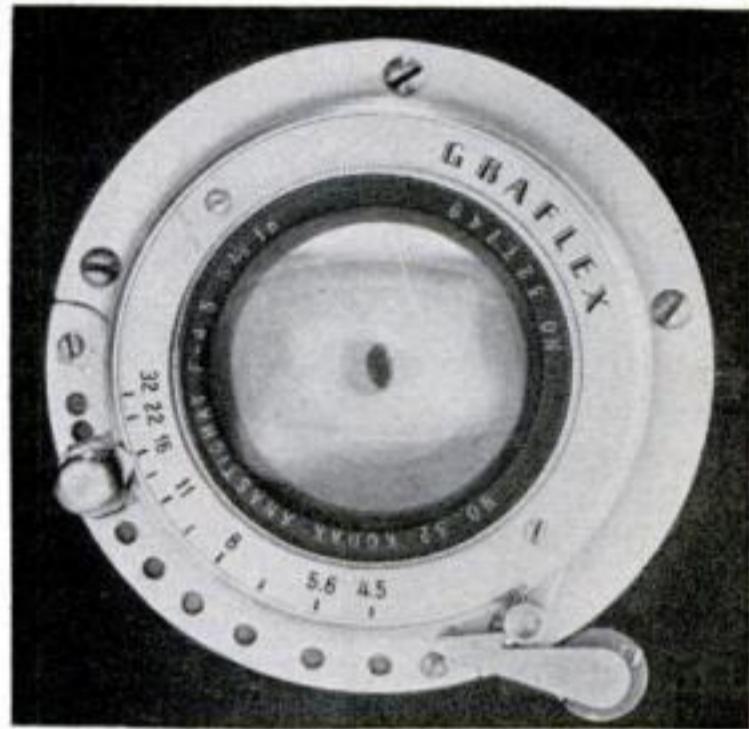
Shadow cast by two large wineglasses. The base of one is over the base of the other. The beam of light fell on the glasses at a 75-deg. angle

Orange or yellow tissue is laid on the sensitized paper to prevent premature exposure. The object may then be shifted about to get the best effect





## FOR CAMERA USERS



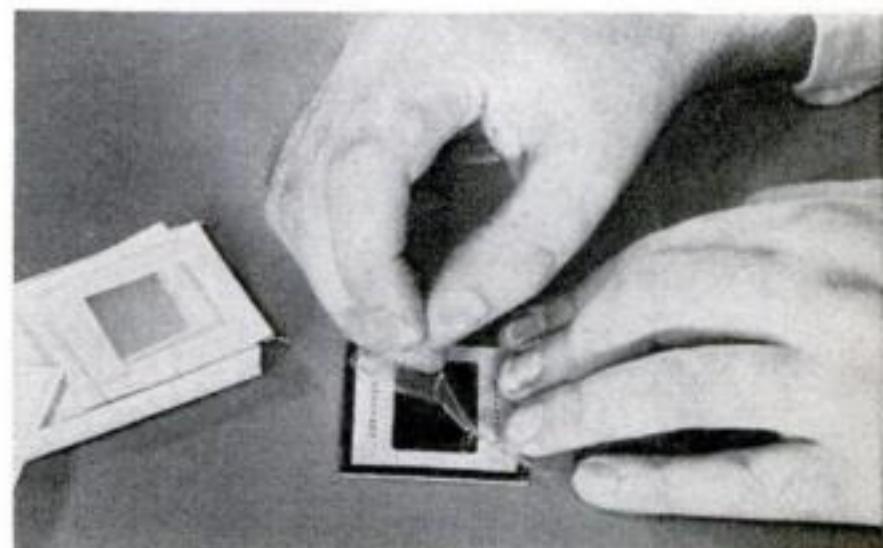
**AN AUTOMATIC DIAPHRAGM** is the outstanding feature of a new Graflex camera. It permits the subject to be viewed with the maximum possible brilliance, and with the plane of sharpest focus clearly defined, right up to the instant of exposure. The diaphragm is first preset to the value desired for exposure, and is then opened wide for focusing. The moment the release is snapped and before the shutter opens, it automatically returns to the first setting.

To users of single-lens reflex cameras this innovation offers a great advantage. When flash pictures are to be made, when pictures must be taken in bright outdoor light on beach or snow, when extreme close-ups are to be made of children or animals, the lens must be used wide open for good focusing and composing. The act of subsequently

stopping down the lens before exposure often causes the photographer to miss the vital action, shift focus, or ruin the framing. The new diaphragm eliminates this worry.

In addition, the new Graflex boasts a built-in synchronized open-flash mechanism which is claimed to be practically missproof. Contact to fire the lamp is made by a silvered spring attached to the mirror. When the mirror release is depressed, the mirror rises and ignites the lamp just before the curtain begins to close, giving an exposure determined by the duration of the lamp used. Using the new type SM quick-firing flash lamps, exposures may be made as fast as 1/200 second—more than ample to catch most animated subjects in the home. By using a Kodatron lamp, stop-action photos may be taken at 1/30,000 second.

**COLOR FILMS** and transparencies can be mounted by a new method that eliminates the use of glass, tapes, clamps, and other accessories. The mount is a clear protective covering banded with a self-sealing adhesive, which the manufacturer claims will not dry or crack with age. The adhesive is protected by a thin covering. This is peeled off, and the mount is pressed against the color film; the other side of the transparency is then protected in the same way. Twenty transparencies can be mounted by this method in ten minutes.



# Little Brother

## OF THE BIG HOLLYWOOD MOVIE CAMERAS

**E**MBODYING many of the refinements of professional 35-mm. movie cameras, a new 16-mm. outfit has been introduced, and the first model is being used by a Hollywood producer for commercial pictures. It is box-shaped, carries outside film magazines, and is fitted with a large four-lens turret.

The camera has two intermittent movements, which are interchangeable—one for microscopically accurate registration when shooting silent; the other a silenced movement for use when both sound and pictures are to be recorded.

In order to focus, the operator presses a button so that the head can slide out of the way. This movement brings into place behind the lens a focusing magnifier, mounted on the door and carrying at one end a ground-glass screen in the same focal plane as the film. The eyepiece is adjustable, and a highly magnified section of the scene may be viewed for critical focusing.

Operating controls at the rear include a manual control for a 170-deg. shutter and buttons to operate an automatic shutter dissolve. There are also footage and frame counters. To fade out, the operator simply touches a button, and the shutter closes during the exposure of 18" of film. For a lap dissolve, he releases the brake when the shutter is closed, reverses the motor to wind the film back to the start of the fade,

A side view of the new camera, which has a four-lens turret. Pilot pins and registering leaves hold the film in perfect alignment during exposure

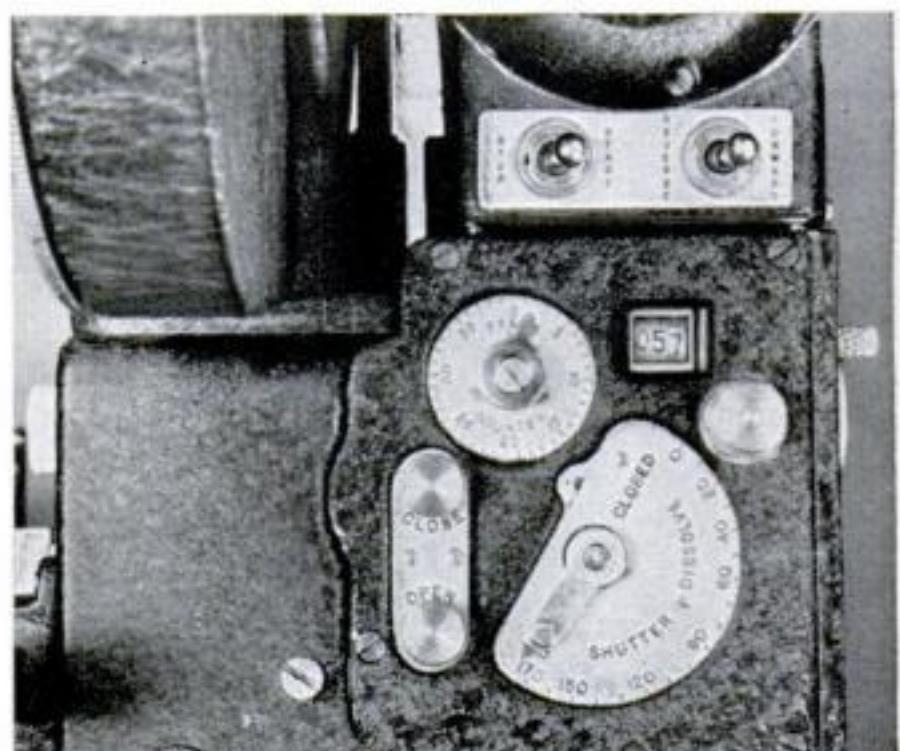
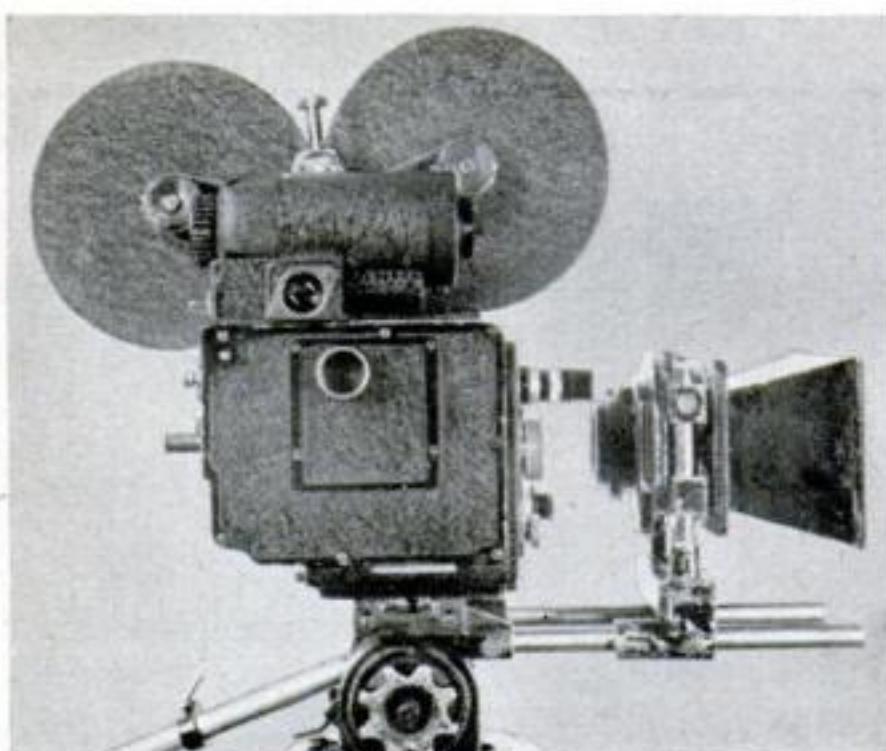


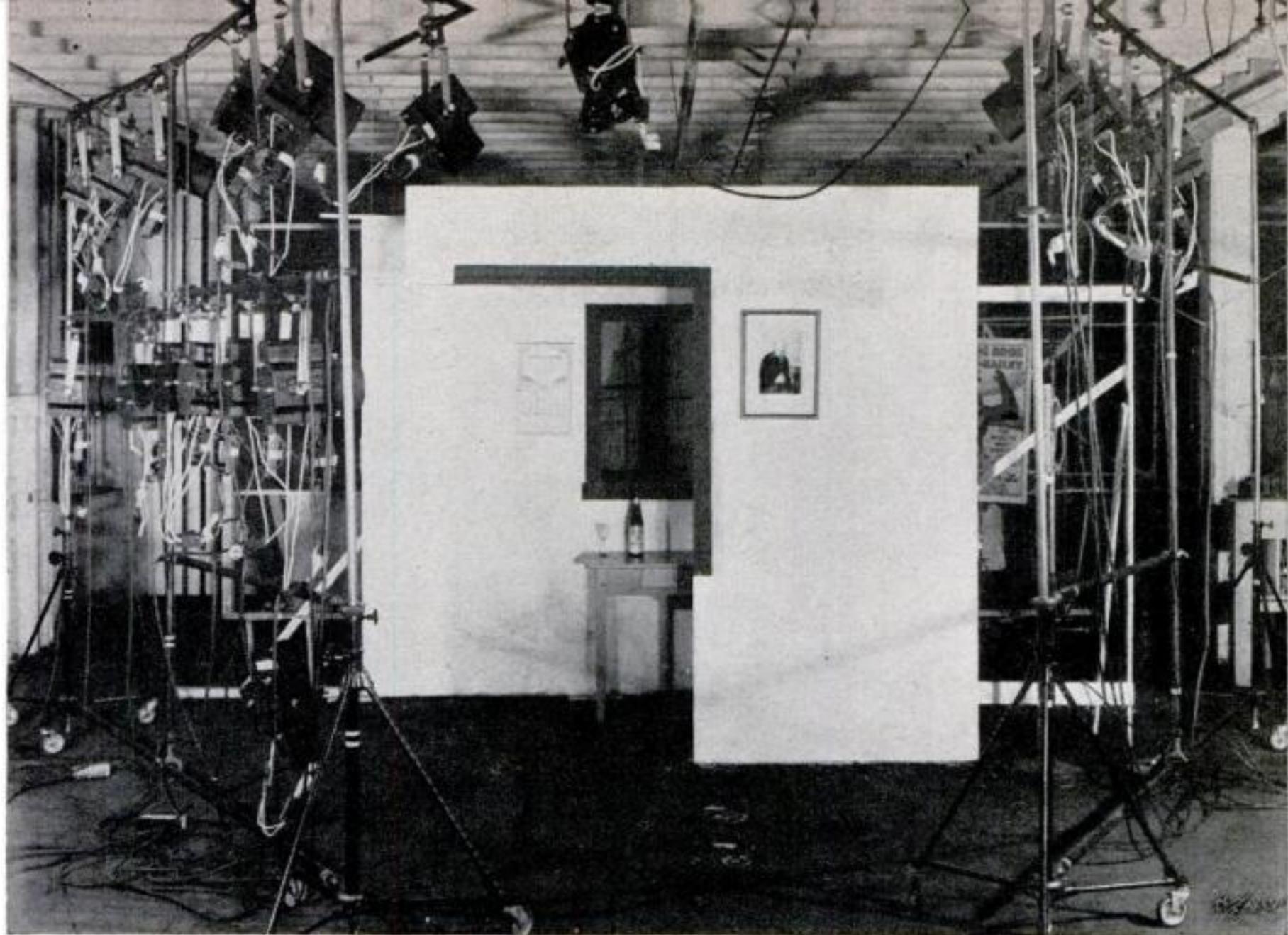
When the head of this 16-mm. camera slides aside, a ground-glass screen with an adjustable magnifying eyepiece moves into place for critical focusing

switches to forward, and then presses the fade-in button.

The camera is provided with two motors. One is of variable speed for silent shots and runs both forward and backward on 110-volt A.C. or batteries; the other is synchronous, operating only on 110 volts, and is used when recording sound. For stop-motion pictures, a third motor may be mounted in a space provided for the purpose.

How the controls are grouped. Dissolves and fade-outs can be made by simple manipulation. The camera has two intermittent movements and two motors





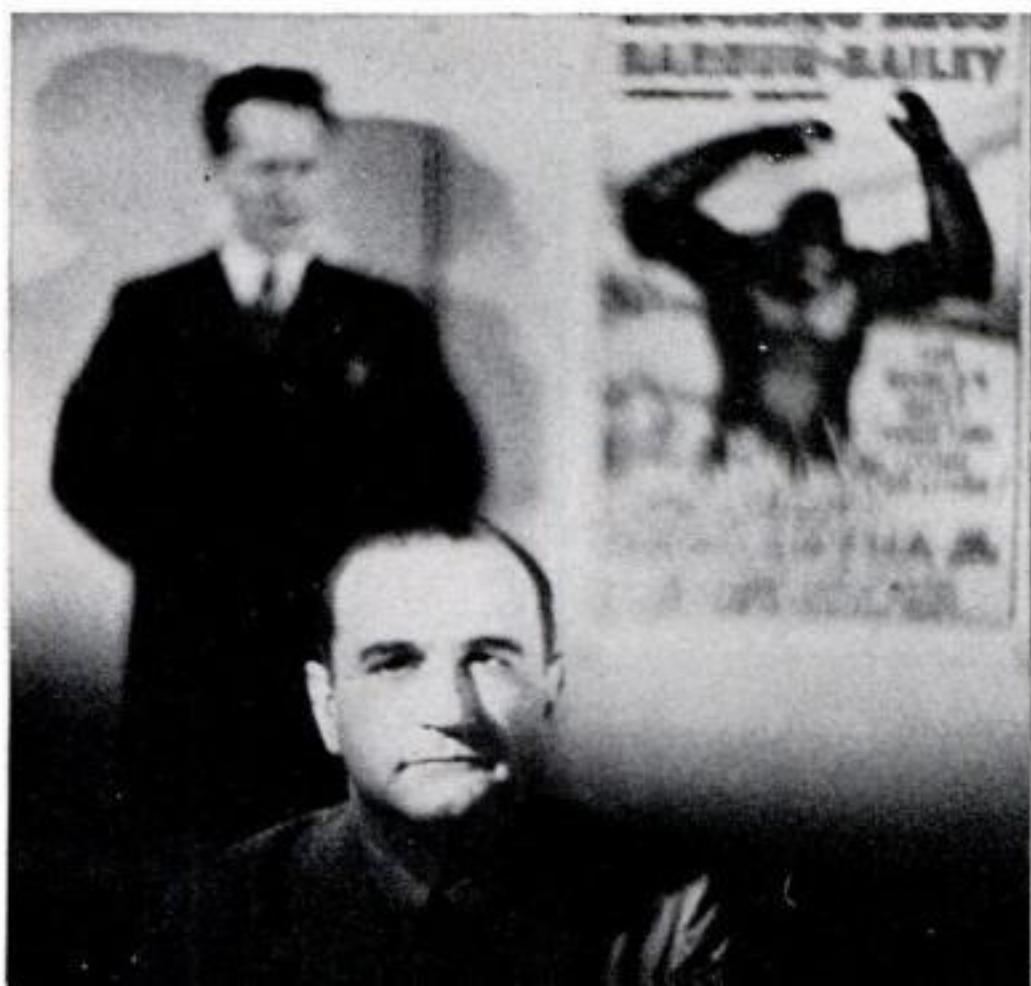
Banks of lights illuminate the set piecemeal in synchronization with a focus-changing device on the camera

## Revolutionary Invention Gives Movies Great Depth of Focus

MOTION-PICTURE scenes in which both close-ups and background are simultaneously in sharp focus are possible with a system of photography invented by Dr. Alfred N. Goldsmith, of New York, and his associates, Harry R. Menefee, William Mayer, and Fritz Kastilan. Known as the "increased-range system," it makes it possible to use the full aperture of lenses as fast as  $f/1.4$  and still keep all parts of the set in sharp focus, thus allowing actors to move freely about.

An optical-glass shutter revolving between lens and film operates synchronously with banks of lamps that flash on and off in rotation forty-eight times a second and successively illuminate the set from front to back. To the eye, the lighting seems uniform and constant. The optical shutter, however, continuously alters the focus of the camera in step with the lighting banks, so that near, medium, and far shots are recorded in each picture in rapid rotation. When projected, the scene appears naturally illuminated.

Two photos taken to illustrate the difference between ordinary and "increased-range" photography. Both were taken at  $f/1.4$ . The foreground figure is 8' from the camera; the background 18' away

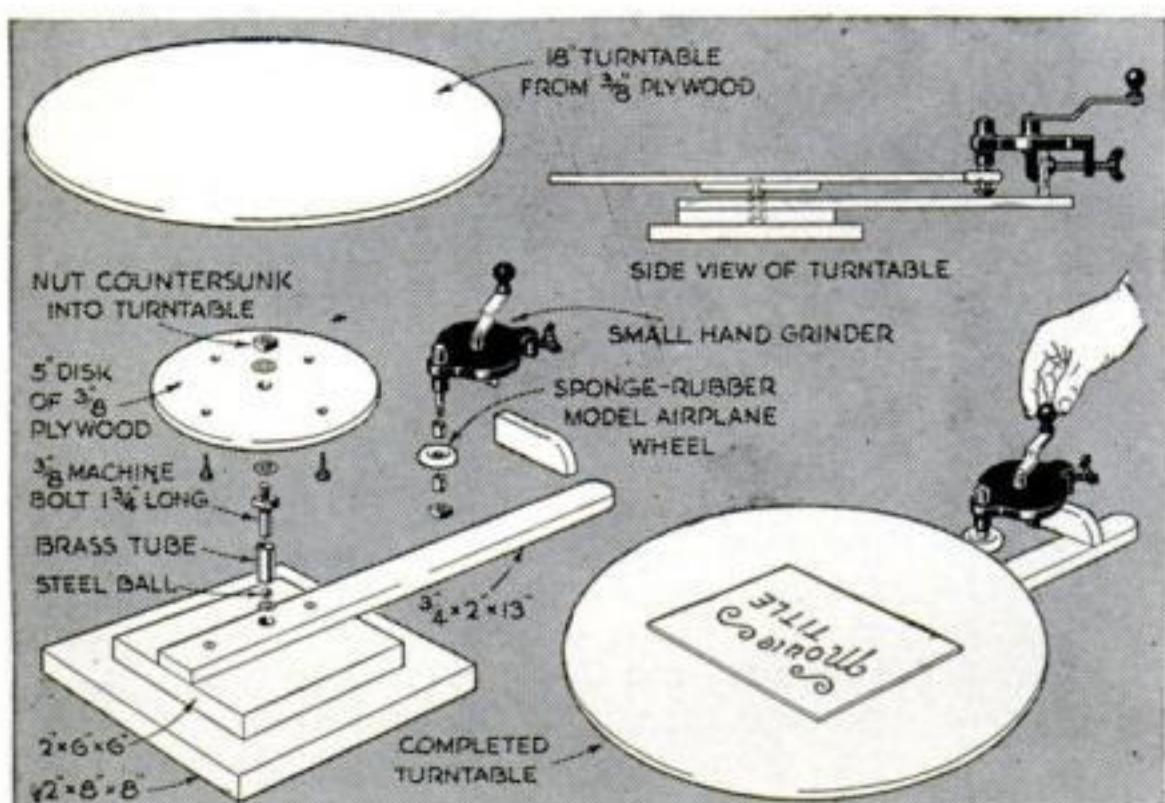




## Homemade Movie Turntable Produces Trick Titles

BY SPINNING titles, still photographs, or small objects on a plywood turntable such as the one illustrated, the amateur movie maker can obtain unusual effects and duplicate many of the professional tricks used by Hollywood. The construction is made clear in the accompanying drawings. Screw the large 18" disk fast to the smaller one from underneath. The spindle is a bolt threaded at the end only, with the head cut off. File the lower end smooth to rest upon the steel ball without friction.

Because of its high gear ratio, the hand grinder gives a wide range of speeds and good control. The ball thrust bearing makes it easy to spin the table even when it is heavily loaded. A sponge-rubber tire from a model-airplane wheel is used for the friction drive, and greatly helps to eliminate vibration.—M. G. WINTERTON.



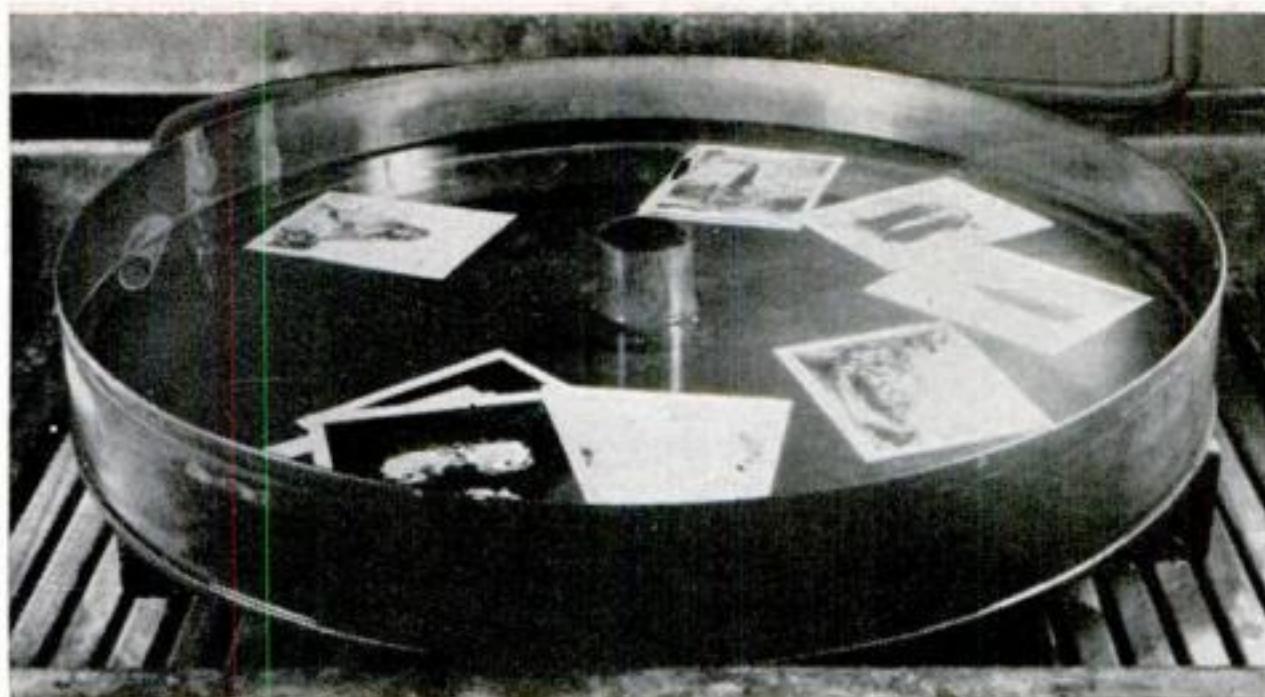
Construction of this home-movie title turntable requires no lathe. The plywood disks can, if necessary, be sawed out by hand. Place a small metal disk or washer under the steel ball to reduce friction at that point. Pressure of the sponge-rubber drive wheel against the turntable is adjusted by shifting the grinder slightly sideways

*Majestic  
Mt. Rainier  
Nature's  
Masterpiece*

## Dried Spot of Ink Aids in Focusing Enlarger Accurately

IN FOCUSING an enlarger accurately, photographers often use a piece of dense film on which a number of scratches have been made. At rather large magnifications, however, this does not seem to give the desired degree of critical control. After a number of experiments, I found that by letting a large puddle of India ink dry on a piece of clear film, the ink develops a myriad of cracks, which range from very coarse ones

to those far too small to be seen with the naked eye. When this inked film is placed in the enlarger and projected, even at the greatest magnification, there are still many fine, sharp lines on which to focus. I have incorporated a piece of film thus treated in my negative carrier so that at any time, by sliding the negative carrier halfway out, I can focus the enlarger or check its focus very accurately.—A. L. ELLIOTT.



The amateur photographer can construct this simple self-siphoning print washer himself or have it made by a tinsmith. It keeps a flow of fresh water reaching all prints constantly, yet requires no attention. The 24" tank accommodates 8" by 10" prints. Monel metal, stainless steel, or galvanized iron may be used

## Efficient Print Washer Flushes Itself Automatically

By CHARLES H. COLES

Chief Photographer of the American Museum of Natural History, New York

WASHING photographic prints correctly is so important that too much attention can hardly be given it. Experts agree that complete changes of water and thorough access of water to all prints are necessary, but to so wash prints by hand requires constant attention. The entirely automatic washer illustrated does the work perfectly and can be built at home in any size desired. Galvanized iron, if properly painted, may be used for all the parts.

To make the circular washer shown, a disk 24" in diameter is cut from the sheet metal and a 1 3/8" hole cut in its center. A 1/2" wide strip is then soldered around the edge of this hole to form a flange on one side of the disk. One edge of another strip, 3 1/2" wide and 76" long, is rolled over, and the strip then soldered around the outer edge of the disk to form the tank.

A piece of 1" pipe 4" long must be soldered into the 1 3/8" hole. It may be necessary to shim up this pipe with sheet metal to obtain a close fit in the hole. Do not use pipe with an inside diameter of more than 1", as larger pipe will not create sufficient suction to operate the siphon.

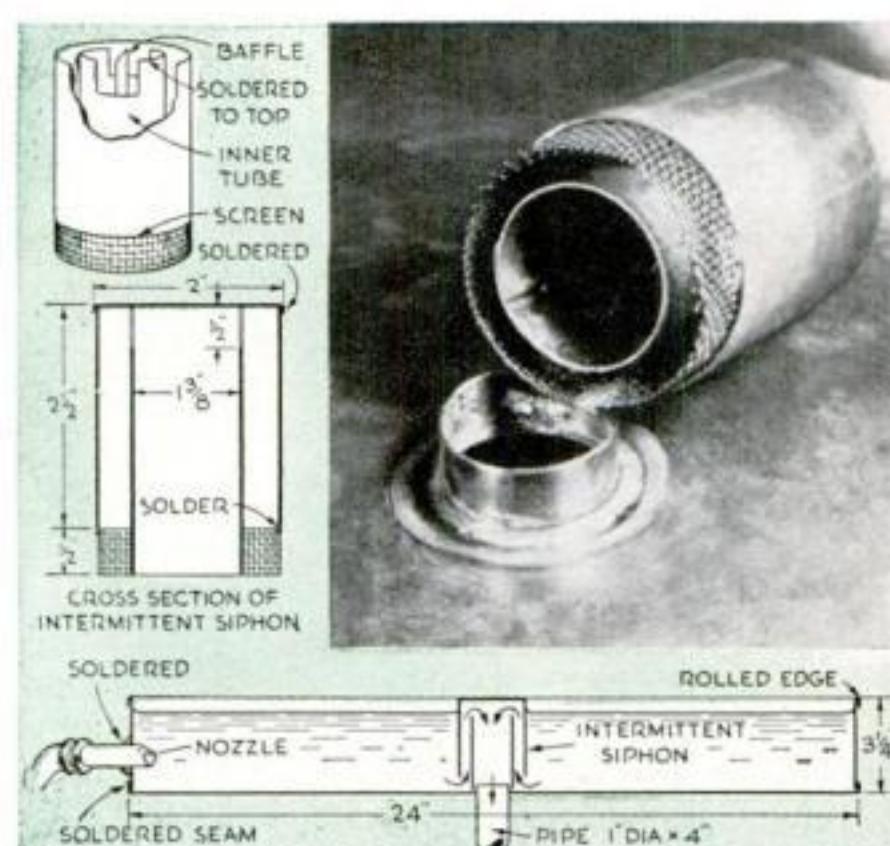
The water spout is a piece of 3/4" pipe 4" long with a hose connection soldered to one end. Hammer the other end to a flat nozzle and solder the pipe at an angle of about 30 deg. into a hole cut halfway up the side of the tank.

The automatic siphon consists of two metal tubes, one 1 3/8" in diameter and 3" long and the other 2" in diameter and 2 1/2" long. The 1 3/8" tube has its top end cut down 1/2", leaving only two lugs by which it is soldered to the center of a 2" disk, which in

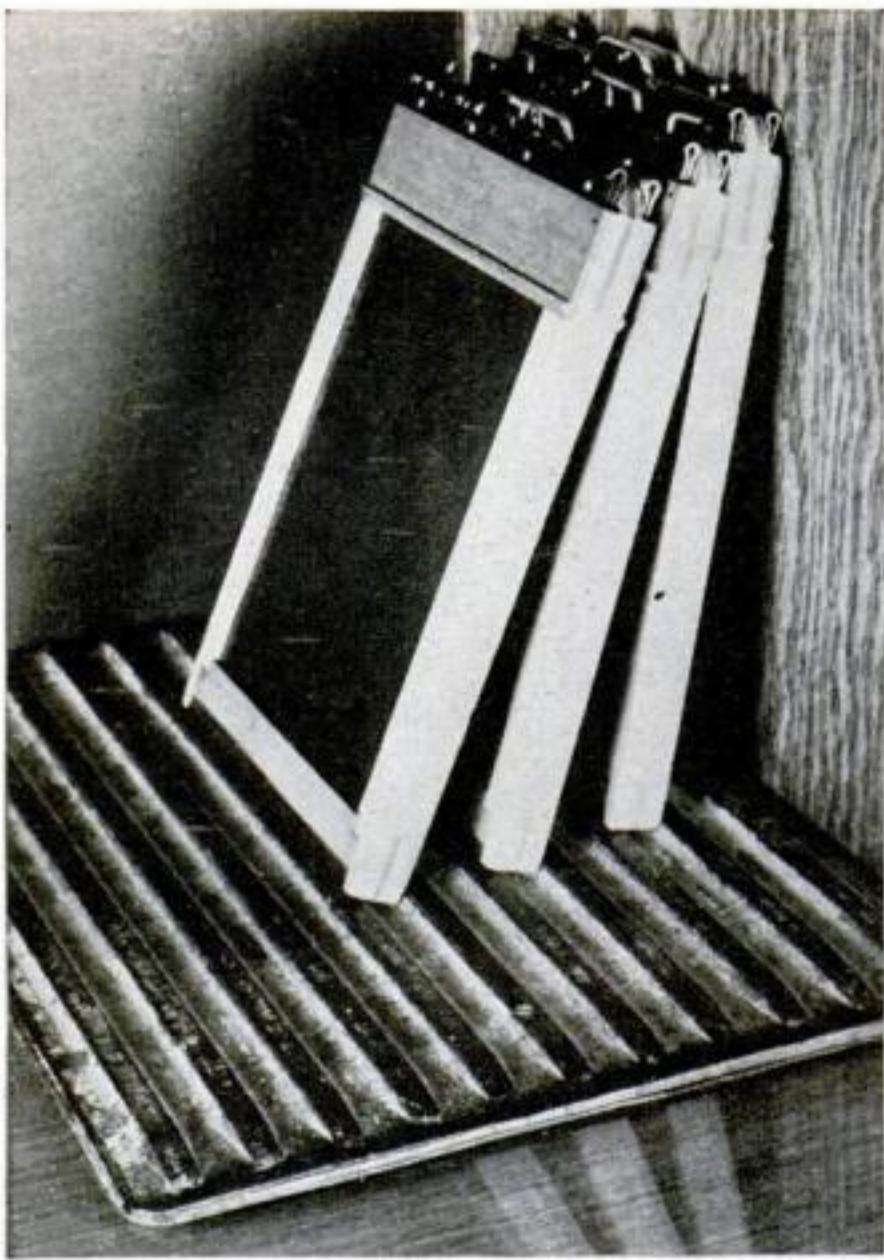
turn is soldered to the 2" tube. A piece of monel-metal screening is soldered to the bottom of the 2" tube to prevent prints from being drawn into it during the discharge of water.

To prevent the forming of a vortex that might destroy the siphoning action, a baffle plate, consisting of a piece of sheet metal 1 3/8" by 3", is pushed lengthwise into the inner discharge tube. This breaks up any rotary motion of the water. A similar baffle may be needed in the lower 1" pipe also.

In use, the tank gradually fills with water, the prints moving around by the force of the jet. When the tank is full, siphoning begins and almost completely empties it, taking out the chemical-laden water. When the level falls below the end of the screened siphon tube, air enters, breaks the siphon, and allows the tank to fill again.



Above photo shows bottom of siphon tube and flange over which it fits. The tank repeatedly fills and empties, draining used water from the bottom



## Rubber Battery Mat Prevents Film Holders from Sliding

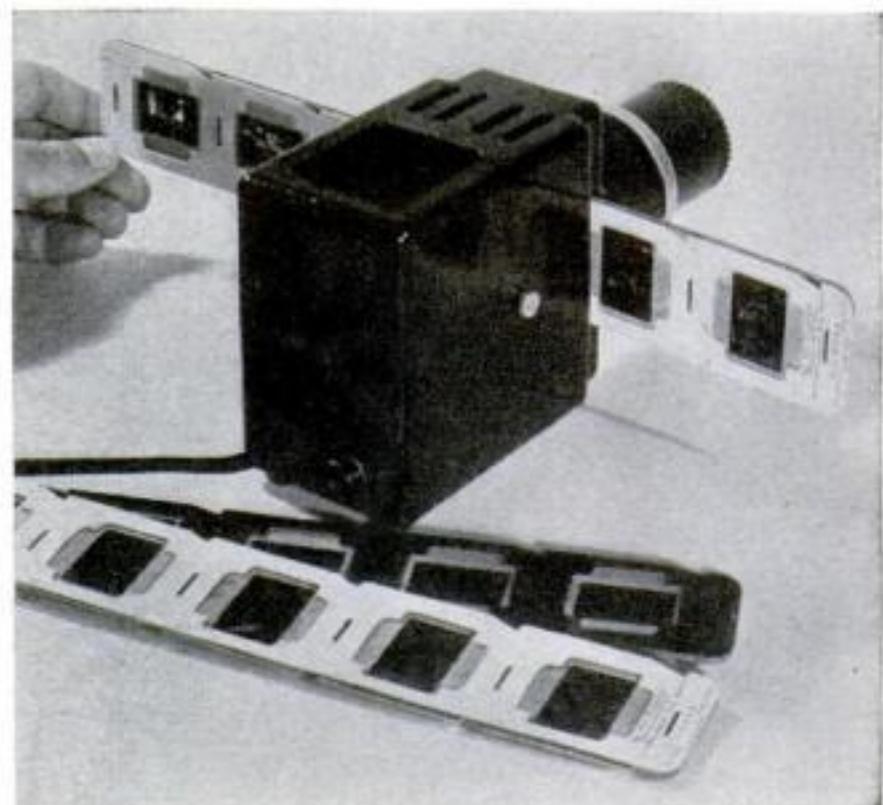
A CORRUGATED rubber mat of the type used under storage batteries is a convenience on the loading bench of a photographic darkroom. The cut-film holders stand up firmly in the grooves of the mat and may be readily located in the dark.

## Making Developer Last Longer

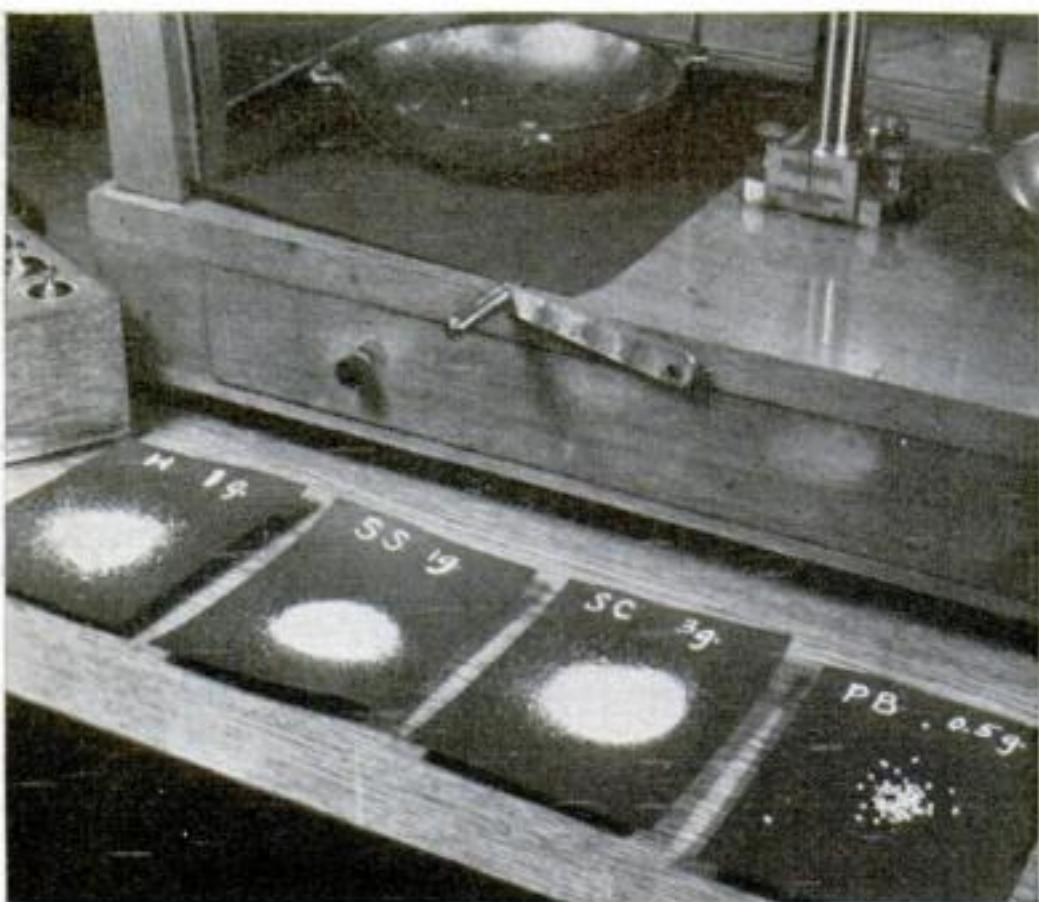
TO DELAY oxidation of a photographic developer, the bottle should be kept filled to the neck so that very little surface of liquid will be exposed to the air. One way to do this is to add glass marbles to make up for any small quantities lost during use.

## Combination Projector Strip and Transparency File

FILING and viewing transparencies are both made more convenient with a combination film index and projector strip that is now on the market. Each strip takes six transparencies, and contains space for index data. A case is available for holding 36 strips.



## Black Paper Slips Aid in Weighing Photographic Chemicals



THE BLACK paper sheets packed between pieces of cut film are useful in weighing chemicals, especially when you are making up a complicated or unfamiliar formula. It pays to save them for this.

Use as many of the sheets in each instance as there are ingredients, and mark on each with a red pencil the abbreviated name of one ingredient, together with the amount required. Put a blank piece of the same paper under the scale weights. Then weigh the required amounts of chemicals directly on the marked sheets. Both the quantities and the ingredients can be checked again after weighing, then mixed or dissolved in proper order with complete assurance that no error has been made.—C. C.

# *Snapshooting* the Winter sport of millions



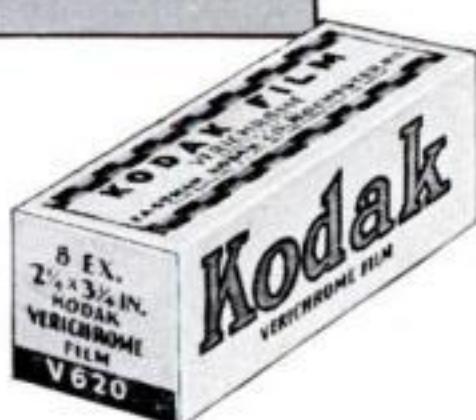
AMERICA takes its pictures when and where it finds them—winter and summer...indoors and out. (Millions of winter snaps last year.)

Winter picture takers are getting grand results—summertime results. For America now knows its film. Knows that

Kodak Verichrome Film gets the picture winter and summer. Knows that Kodak Super-XX Film has speed to spare—so snapshots indoors at night turn out as splendidly as daytime pictures.

Step up your picture-taking fun, snapshoot right through the winter.

## *Outdoors*



## *Indoors at Night*

Use Kodak Super-XX Film with Photoflood bulbs and inexpensive reflectors for snapshots at night. **Booklet free at your dealer's.** Also covers flash pictures. Eastman Kodak Co., Rochester, N. Y.

Use Kodak Verichrome Film outdoors in winter. It brings extra assistance—helps overcome small exposure errors, lets you get swell snapshots even in dull weather.

**Winter and Summer—you can always count on KODAK FILM**

# TOUGH...

BUT OH SO GENTLE



## TOUGH ON OIL-PUMPING GENTLE ON CYLINDER WALLS

● It's always bad to waste things—it's doubly bad right now!

\* \* \*

Save oil—save gasoline—prevent needless wear.

\* \* \*

Simply get Hastings Steel-Vent Piston Rings. They stop oil-pumping instantly—and check cylinder wear. Any good mechanic can install them—quickly and economically.

Note to Used Car Buyers: Ask the dealer if it's Steel-Vent Reconditioned. It's a better buy if it is.

HASTINGS MANUFACTURING CO., HASTINGS, MICH.  
Hastings Mfg. of Canada, Ltd., Toronto

**HASTINGS** →

STEEL-VENT PISTON RINGS  
Stop Oil-Pumping  
IN CARS, TRUCKS AND TRACTORS

## Gus Keeps 'Em Rolling

(Continued from page 144)

held its lower end in contact with various parts of the engine. After a few minutes he raised his hand. "Switch her off," he told Ez. "There's nothing the matter with your bearings. That rap is coming from—or from somewhere near—your fuel pump. Ever had any trouble with it?"

"I've had trouble with pretty near every gol-dern gadget anybody's ever stuck on an automobile," Ez declared feelingly. "But I ain't never had any trouble with this particular fuel pump."

Gus examined the pump. "Clearance between the cam and the fuel-pump arm might cause that rapping," he said, "but that's not at all likely. Let's see, now—your fuel pump and your vacuum pump operate from the same rocker arm, but work off two different links in the fuel-pump housing. Start your engine again, Ez."

Ez did as he was told. "Switch her off," Gus said after a few seconds. "I've got it. Those two links are hitting against each other! That's what's been making that noise. Probably the trouble is caused by a broken diaphragm."

"So that's it, hey?" Ez said. "I ain't a very good guesser, am I? Well, I guess puttin' in a new diaphragm ought to fix it up."

"It might," Gus said. "And then again, it mightn't. You just saw me put a new fuel pump on Doc Foley's car. Your bus needs one a lot worse than his does."

"I mighta knowned you'd manage to sell me somethin' before I got outa this place," Ez grumbled. Then he grinned broadly. "Sure—put it on, Gus. Whatever you say about automobiles is jest as good as Scripture to me!"

After Ez had driven away Gus glanced at the shop clock. It was close to eleven. He went into the office and found Joe Clark nodding over a ledger. Poking his partner playfully in the ribs he told him that he'd better wake up and go home.

Joe yawned extensively. "How about you?" he wanted to know. "You've worked about thirteen hours today."

Gus grinned at him. "Don't worry about me," he said. "We've got a lot of good customers who have a lot of not-so-good cars, and we've got to keep 'em rolling—that's our job! Drive Doc Foley's car over to his house on your way home, will you, Joe? I was going to do it myself, but I've just had a bright idea for that gadget of mine, and I want to do a little work on it before I hit the hay."

# "I WAS BOUND AND GAGGED AND LEFT TO DIE!"



*A true experience of JOSEPH J. KARES, Charlestown, Boston, Mass.*



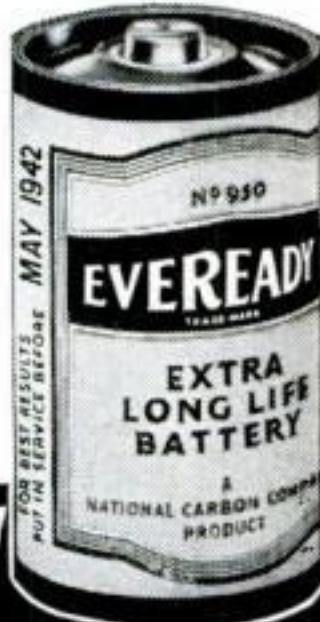
**"FURIOUS STRUGGLING** only tightened my bonds. My arms and legs grew numb with cold. My plight was desperate! Then, remembering my flashlight, I managed to reach it . . . started flashing SOS against the top of the lumber.



**"FOR MORE THAN AN HOUR** I kept signaling. Half dead with cold . . . about to give up hope . . . I was at last rescued by two officers from my ship. If it hadn't been for those dependable 'Eveready' *fresh DATED* batteries I would have been a goner.

(Signed) *Joseph J. Kares*

*The word "Eveready" is a registered trade-mark of National Carbon Company, Inc.*

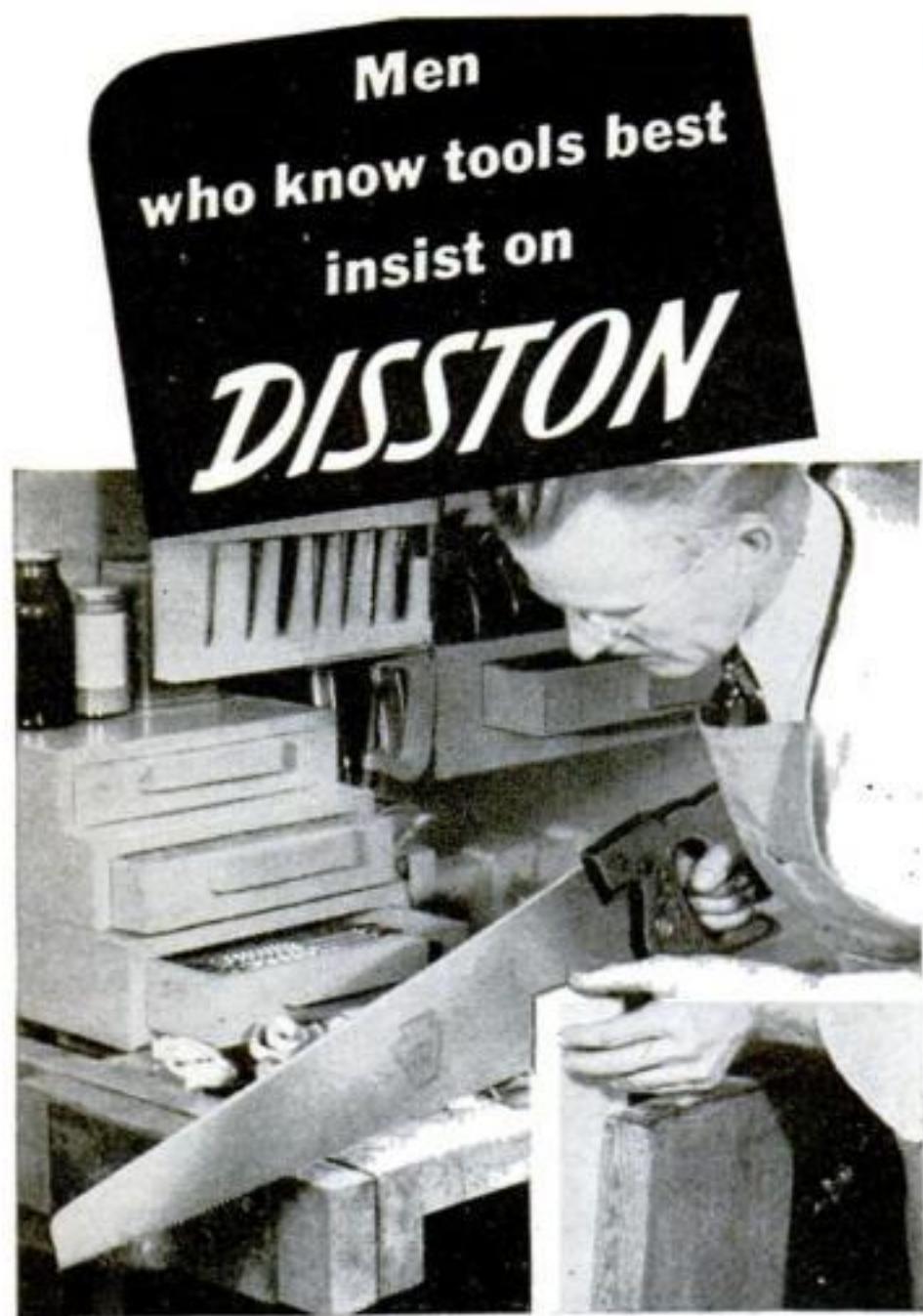


**FRESH BATTERIES LAST LONGER... Look for the DATE-LINE**

NATIONAL CARBON COMPANY, INC., 30 EAST 42nd STREET, NEW YORK, N. Y.

*Unit of Union Carbide and Carbon Corporation*





Men  
who know tools best  
insist on  
**DISSTON**

Perhaps no one is quite so discriminating in his choice of saws and other tools as the man whose hobby is his home workshop. That's why so many of these craftsmen insist on Disston.

#### **Disston for performance:**

Whether you're working with wood or metal or plastics, you'll appreciate and enjoy the easier, speedier cutting provided by Disston circular saws and dado cutters, band saws and chisels and files.

#### **Disston for craftsmanship:**

You can make the most of your skill when you work with precisely balanced Disston saws and other tools. Results...more enjoyment for you and better looking finished products.

Ask your dealer for Disston tools, made to last longer of tough Disston Steel.

#### **HENRY DISSTON & SONS, INC.**

1210 Tacony, Philadelphia, Pa.  
U.S.A.



**FREE MANUAL**, with valuable hints on how to use and care for saws, tools and files, is yours for the asking. Write for your copy today.



## Tanks Can Be Destroyed

*(Continued from page 79)*

and find the enemy and destroy him before he strikes. It embodies the old military principle that the best defense is to hit the other guy first.

As planned today the tank destroyer battalions will be as innocent of self-protection as the naval destroyers and light cruisers of the battle fleet. With its thirty-six 75's and eighteen 37's, the battalion as now set up carries defensively eight 37-millimeter anti-aircraft guns and .50 caliber machine guns for protection against ground - strafing planes. For advance reconnaissance, it has ten light tanks, armored, but the main body is for speed and striking power alone. Its counterpart exists in no army in the world, and it is a typically American conception. To paraphrase the oft-quoted Civil War general, it will be out to get there firstest with the mostest guns.

## Modern Troop Transports

*(Continued from page 85)*

landing boats, and every precaution is taken to assure the safety of the personnel. Life preservers are adjusted and life rafts made ready to put over the side.

In the nation's defensive set-up there must be considered our ability to land troops on foreign soil.

## Master Traffic Plans Urged to Ease Defense Congestion

TRAFFIC CONGESTION threatens to create a new bottleneck in the defense program, according to Capt. C. Reynolds Weaver of the War Department's general staff.

"We soon will have 250,000 military motor vehicles on the nation's highways," Captain Weaver explains. "They range in size from the quarter-ton jeeps to 7½-ton trucks and even larger units. What happens when traffic control fails during military operations has been demonstrated tragically in France."

One way of breaking this potential bottleneck, Captain Weaver points out, is through master traffic plans developed by many cities and communities. Cooperation between military and civilian authorities can prevent conflicts between convoys and civilian traffic and relieve congestion around key industrial plants and on important routes.



YOU CAN HEAR THE RING OF FINE GLASSWARE...



YOU CAN FEEL THE SMOOTHNESS OF A FINE CAR...



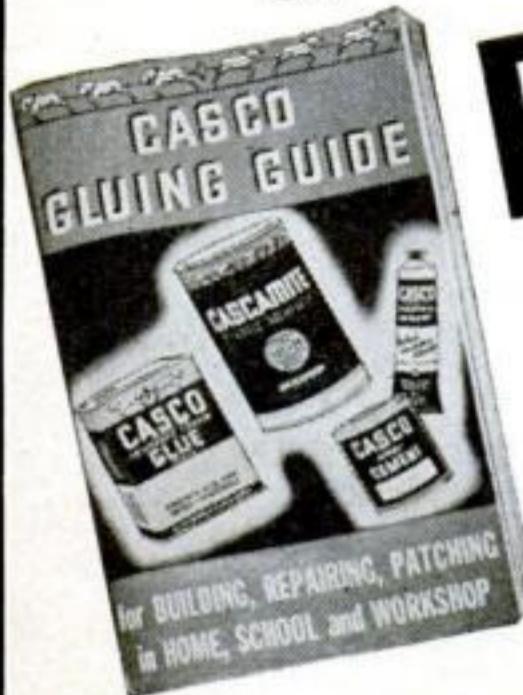
AND WHEN YOU STOP TO GET GASOLINE, THIS EMBLEM  
TELLS YOU WHICH PUMP CONTAINS THE BEST

THE ETHYL EMBLEM on a gasoline pump stands for *extra* quality in anti-knock (octane number) and all-round value. Samples are double-checked by your oil company and the Ethyl laboratories.

In your car, "Ethyl" means a cooler-running engine in summer; a quicker-starting engine in winter; extra power and smoothness all year. When you stop for gasoline, the Ethyl emblem tells you which pump contains the best. **ETHYL GASOLINE CORPORATION, NEW YORK**

THE BETTER THE GAS,  
THE BETTER YOUR CAR

# The book that takes the guesswork out of gluing **FREE!**



36 pages, 56 illustrations. Tells how to make quick, easy household repairs. ... Dozens of home workshop suggestions. This complete homecraft and household gluing guide yours free—just mail coupon below.

The new 1941 CASCO Gluing Guide tells what glue to use on every type of job...gives complete directions for all 3 CASCO adhesives.

## OUTDOOR CONSTRUCTION:

For airplanes, boats, garden furniture, sports equipment, use CASCAMITE POWDERED RESIN GLUE. Waterproof; used by airplane manufacturers with Government Approval. Moldproof. Stainfree. Instant mixing. 10¢ to 85¢ at hardware stores.



## INDOOR CONSTRUCTION:

For furniture, doors, cabinet-work—all heavy-duty interior joints, use CASCO POWDERED CASEIN GLUE. Water-resistant. Easy to mix. 10¢ to 65¢ at hardware stores.



## ODD JOBS:

For quick sticking of dissimilar materials—metal, plastics, fabrics, glass, and other "hard to glue" surfaces—use CASCO FLEXIBLE CEMENT. Ready to use. Large tube, 25¢ at hardware stores.



## MAIL COUPON TODAY!

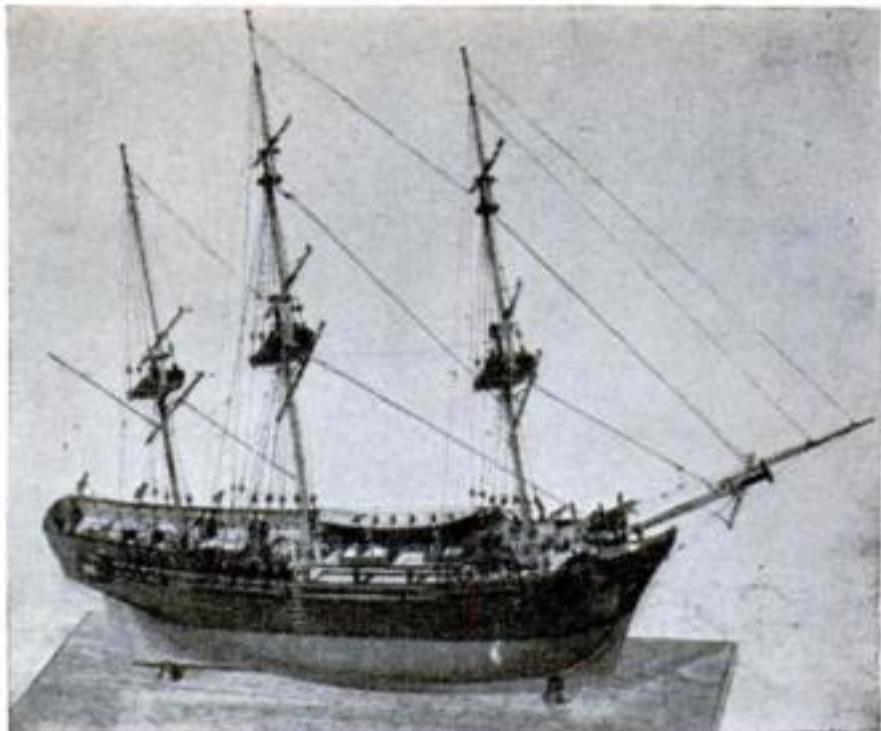
CASEIN COMPANY OF AMERICA, Dept. PS-1241  
350 Madison Avenue, New York, N. Y.  
Send me a copy of the new Gluing Guide.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

Save 2c... Stick coupon on penny post card



## Two Kits for Building Models of H.M.S. "Bounty"

IMMORTALIZED in books and film, the *Bounty*'s story of mutiny and men against the sea appeals to every one. Here is a subject for the model maker's art!

POPULAR SCIENCE now offers two kits of this famous ship. The beautifully detailed model shown above is one any craftsman would be proud to show as his handiwork. About 22" long and 17" high, scaled 5/32" to the foot, it is made from our new kit No. 14S, which includes plans, a precision-shaped, hollowed hull, all materials, and a full set of almost 400 finished fittings. The price is \$19.00\*.

Our kit No. Z (\$1.60) contains materials, but no finished parts, for a very much simplified model of the same ship, 11 1/2" long.

A stamped, self-addressed envelope will bring you a complete list of our kits.

M.	Aircraft carrier SARATOGA, 18" long.....	\$1.00
N.	Convoy of four U.S. destroyers, for aircraft carrier, each 6 1/4" long.....	.75
R.	U. S. Cruiser TUSCALOOSA, 11 3/4" long.....	1.00
5S.	Coast Guard Patrol boat, 165-ft. type, 20 5/8" long; scale, 1/8" equals 1'.....	5.40*
15	Colonial bedroom furniture and accessories.....	1.00

Note: If you live west of the Mississippi River add 50 cents to prices marked with an asterisk (\*).

Popular Science Monthly, Dept. 121A  
353 Fourth Avenue, New York, N. Y.

Please send me Kit..... for which I  
inclose \$..... (or send C.O.D. )

Name \_\_\_\_\_

Address \_\_\_\_\_

City ..... State .....  
(Please print your name and address very clearly)

You save the C.O.D. charge by sending your remittance with this order. Remit by money order, check, or registered mail. This offer is made only in the United States. Also see note above.

# EXTRA STARTING ABILITY



## The Outstanding Characteristic of ALL DELCO Batteries

The final test of a battery is dependable performance during the winter months, when zero and sub-zero temperatures make cars hard to start.

It is during these months especially that *extra starting ability*—an outstanding characteristic of all Delco batteries—stands Delco battery owners in good stead.

There are more than six million users of Delco batteries. More than six million cars, trucks and buses will start surely and dependably this winter because of this *extra start-*

*Replace with a  
DELCO Battery*

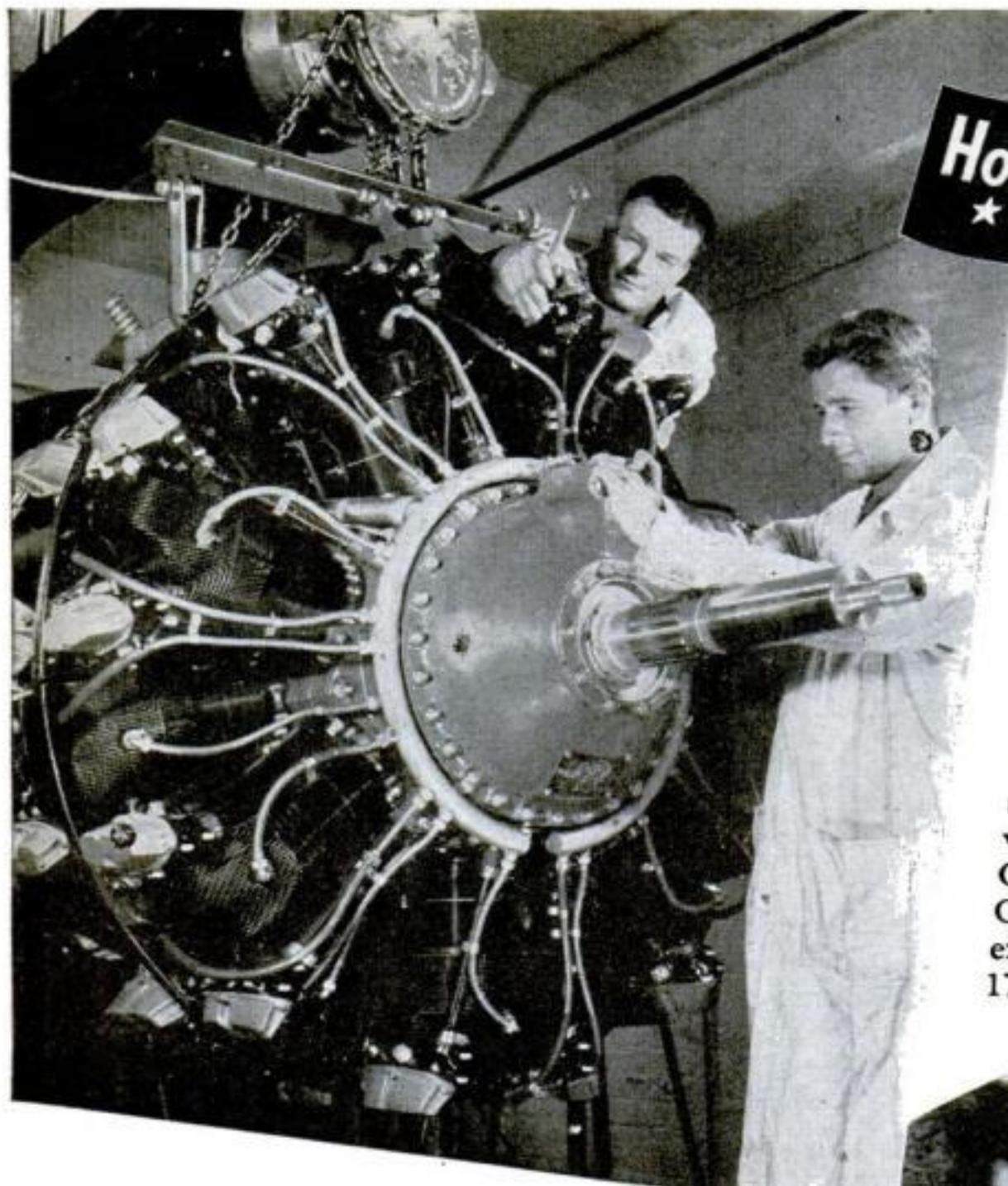
# Delco-Remy

*World's Largest Manufacturer of Automotive Electrical Equipment*

ing ability

that Delco batteries provide. And this year, as in years past, more than 43 per cent of all new cars sold are equipped with Delco batteries. For America's leading automotive engineers have put their stamp of approval on Delco batteries by selecting them for original equipment.

Get a Delco battery for your car. Your Delco battery dealer will show you one that is exactly right for your requirements, whatever make or model car you drive.



## How *Atlas* SERVES THE NATION

No. 2 in a Series of Messages showing how *Atlas* helps in the Defense Program.

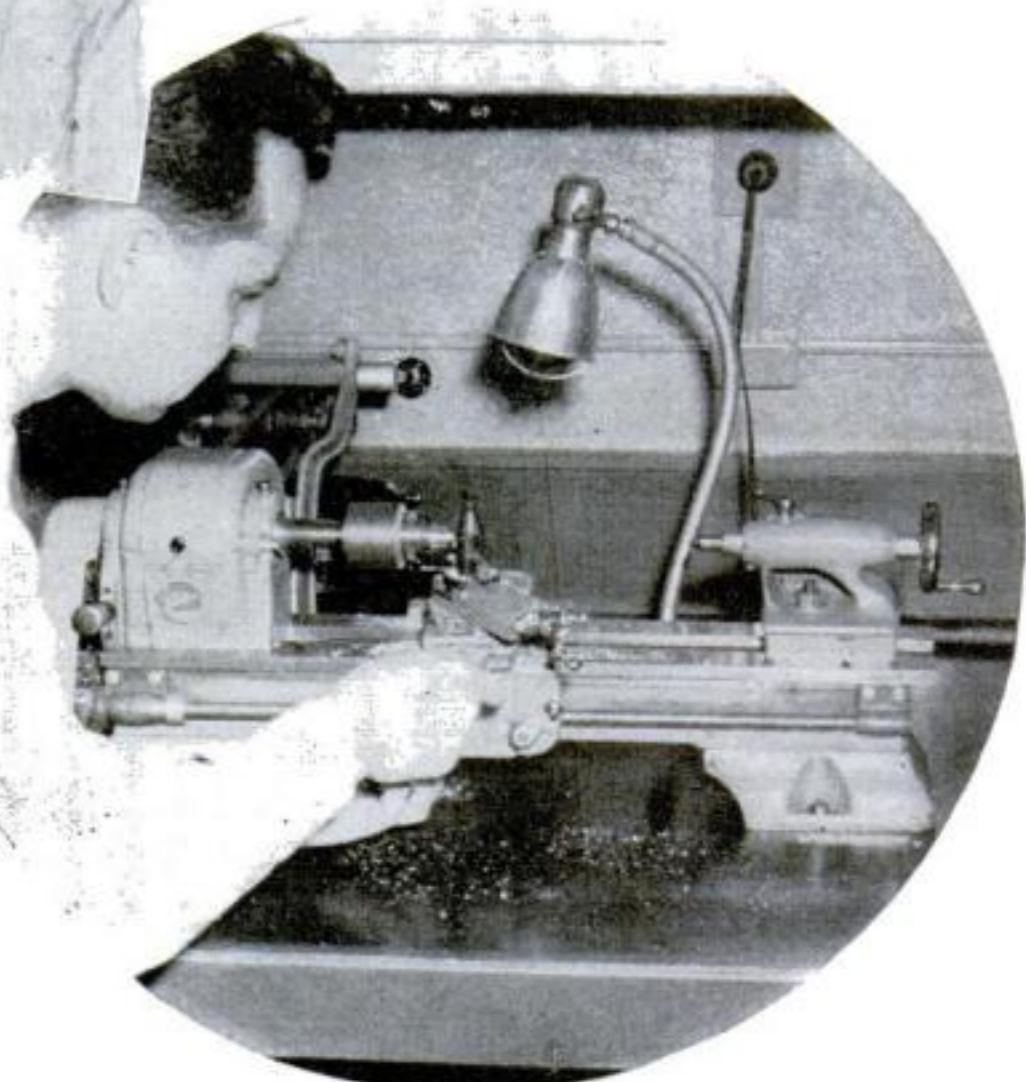
# CYCLONES for DEFENSE

Every mechanically-minded American thrills with justifiable pride at the achievements of the nation's engineers and craftsmen in building mighty weapons for defense. This Wright Cyclone 14 that powers the famous Curtiss Dive Bomber is a typical example—a 14 cylinder double-row 1700 HP radial-type air-cooled engine.

Other engines of the Wright Aeronautical Corporation power Navy Trainers, Army Tanks, Boeing Flying Fortresses, and the huge Douglas B-19.

*Unvarying exactness for absolute dependability* is the keynote of Wright production—to insure safety of pilot and equipment and to maintain the reputation of Wright engines for unfaltering service through millions of flying miles year after year.

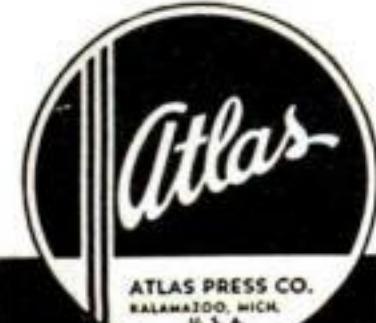
With *precision* and *production* as the goal, America is building an impregnable defense. We are proud of the many helpful ways *Atlas* machine tools are serving the nation.



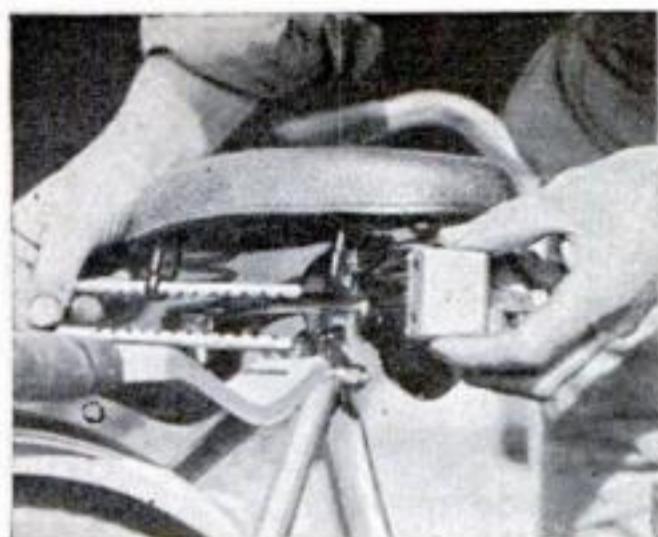
*The *Atlas* Lathe is in regular use in the materials testing laboratories of the Wright Aeronautical Corporation.*

**ATLAS PRESS COMPANY**  
KALAMAZOO, MICHIGAN

LATHES • DRILL PRESSES • ARBOR PRESSES • SHAPERS • MILLING MACHINES

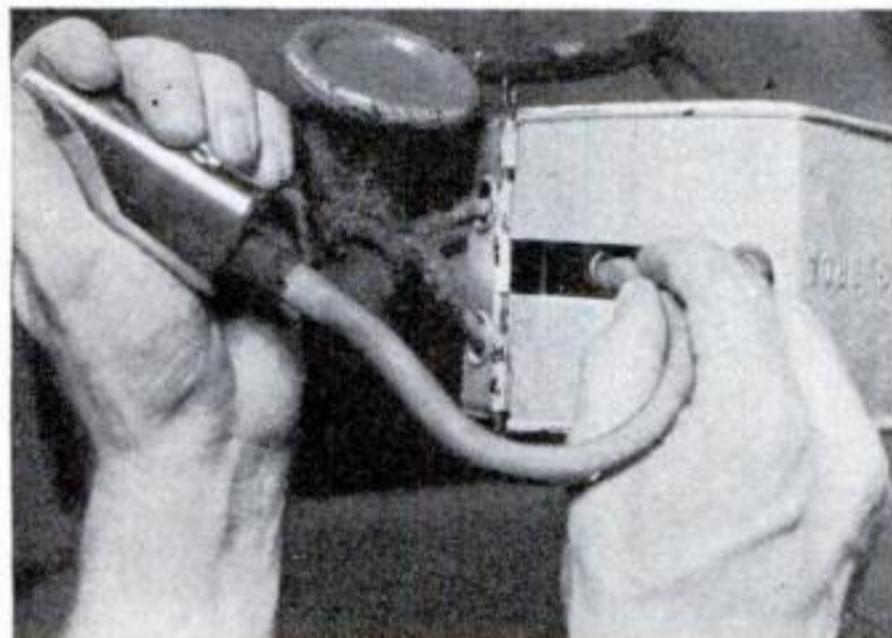


ATLAS PRESS CO.  
KALAMAZOO, MICH.  
U. S. A.



## Bicycle Lock Held Safely Underneath the Saddle

I WAS recently confronted with the problem of providing my daughter's new bicycle with means for carrying a bicycle lock in such a manner that it would not interfere with her riding, would not scratch the enamel, could not be removed by meddlesome persons, and would not rattle. To do this, I obtained two Ford brake-rod clevises, ran an ordinary 5/16" tap through the finely threaded hole in each, and screwed them on the protruding threads of the two bolts at the rear of the saddle. The lock is then carried as shown.—GEORGE GAHAGAN.



## Rubber Flashlight Extension Enters Small Openings

A FLEXIBLE flashlight extension of great utility is easily made from a length of rubber tubing, a piece of rubber-insulated lamp cord, two wooden plugs, and a flashlight bulb socket. The tubing should be  $\frac{3}{8}$ " in outside diameter and not too hard. The glass and filling material of the flashlight bulb are cleaned out, and the connections made as shown.—F. C.



There are better reasons today than ever before for saving things made of metal. Many articles in and around the home can't be replaced, or they're scarce, due to the heavy demand of national defense.

That makes Kester Metal Mender one of the most important items in any home workshop, because it fixes just about anything made of metal, quickly and permanently. Kitchenware, lamps, wire baskets, ornaments and various equipment are just a few of the articles you can repair, and save. Kester is easy to use, no muss; no guess-work; just apply heat and, the job's done.

If you've never done metalcraft at home, try it and see how interesting it is. Kester Metal Mender makes as well as mends. Get acquainted with Kester; fill out the coupon and mail today, for generous FREE sample of the solder and booklet, "How to Use It."



**KESTER**  
METAL MENDER

- Kester Solder Company, 4253-12 Wrightwood Ave., Chicago, Ill.
- Please send me free sample of Kester Metal Mender and "How-to-Use-It" Booklet.
- Name \_\_\_\_\_
- Address \_\_\_\_\_
- City \_\_\_\_\_ State \_\_\_\_\_
- ■ ■ ■ ■ Mail the Coupon Now ■ ■ ■ ■ ■

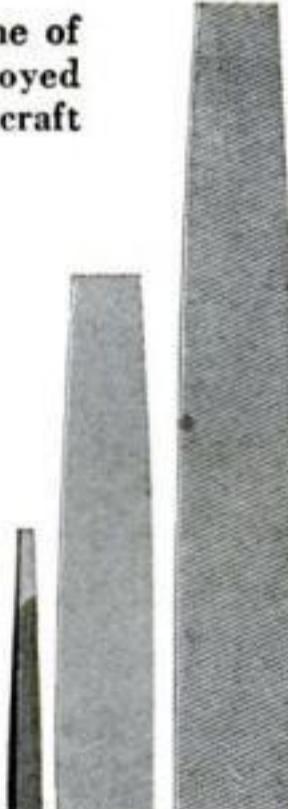


## "WE'LL FIGHT 'EM WITH FILES!"

• • • Which is another way of saying that millions of files in the hands of millions of patriotic workers are doing a tremendous bit toward National Defense—on ships, planes, tanks, trucks, guns, shells and what not.

Above, for instance, you see one of four hand-filing operations employed in the making of 3-inch anti-aircraft shells. The file is a Nicholson.

For speed and accuracy, the surest, smoothest, sharpest cutting and most uniform files are needed. That's why each week hundreds of thousands of Nicholson and Black Diamond files are "entering the service"—in both manufacture and up-keep of defense equipment; in indirect defense activities—mining, lumbering, manufacturing, etc. Available through mill-supply or hardware houses.



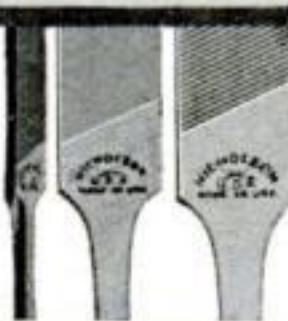
### NICHOLSON FILES FOR EVERY PURPOSE

NICHOLSON  
U.S.A.  
MADE IN U. S. A.

FREE TECHNICAL BULLETINS on any of these special-purpose files for: Stainless Steel, Aluminum, Brass, Foundry Castings, Die Castings, Die Making; Shear Tooth and Lathe filing.

NICHOLSON FILE CO., 19 Acorn St.  
Providence, R. I., U. S. A.

(Also Canadian Plant, Port Hope, Ont.)



Early Colonial pine chest, plan 308A, 25¢

### Our Tested Blueprints Help Solve Your Gift Problems

LESS than two months to Christmas, and time to start making those gifts you've been thinking about! If you're puzzled as to what to build, perhaps the following list will be of help. Our tested blueprints will make your work easier and enable you to do it more quickly, whether you're building a bird house or a racing sailboat. And, of course, if you have a workshop fan on your list, you can give the blueprints themselves as a gift.

If the article you wish to make isn't listed here, it may appear in our blueprint catalog, which you can obtain by simply sending us a stamped envelope addressed to yourself.

#### GIFTS FOR MEN

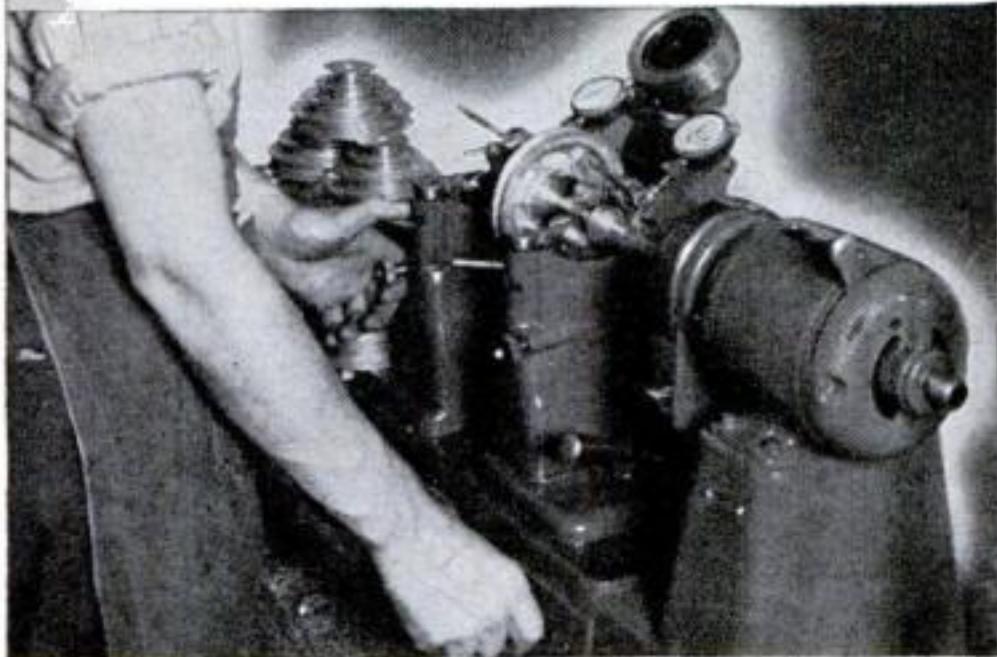
Cabin Cruiser, 17' long weighs 750 lb., for use with inboard or outboard motor from 2 to 10 h.p. 356-357-358-359-R	\$1.50
Canvas-Covered Duck Boat, 13' 6" long, 279-R	.50
Clipper Ship Model GREAT REPUBLIC, 31½" hull, 272-273-274-R	1.25
Colonial Writing Desk, 21	.25
Confederate Raider ALABAMA, 21½" hull, 335-336-337-R	1.50
Locomotive, HO gauge, Hudson type, 14" long, driven by 6-volt motor, 329-330-R	.75
Outdoorsman's Lightweight Trailer, 10' long, 4' wide, 4' 9" high, kitchenette on back, 300-301-R	.75
Racing Sailboat BLACKCAT, 13' 4" long, weighs 250 lb., Marconi rigged, 321-322-323R	1.00
Sandpaper Cabinet, Sawhorse, Hand-Screw Rack, Tool Rack, and Machinist's Hand Vise, 368A	.25
U. S. Battleship TEXAS, 3' long, 197-198-199-200	1.00
Utility Rowboat, 13' long, 224-R	.50

#### GIFTS FOR WOMEN

Aluminum Relish Dish, Turned Nautical Match Holder, Daylight Screen for Color Slides, 409A	.25
Folding Wall Brackets (turned), Treble-Clef Bud Vase (metal or plastic), Vacuum Cleaner Attachment Rack, 408A	.25
Kitchen Table Cabinet, 27	.25
Mirror Frame, 246A	.25
Modernistic Folding Screens, 91	.25
Mosaic Serving Tray, 297A	.25
Queen Anne Dressing Table, Stool, and Mirror, 295A	.75
Rolled-Edge Metal Tray, Table Centerpiece for Easter (rabbit hitched to wagon), Bronze Hammer, 407A	.25
Sewing Cabinets, Priscilla and Modern, 31	.25
Silverware Chest on Stand, 256A	.25
Spool-Turned Table, 22" by 48" top, 290A	.25
Tile-Top Tables, wood and metal, 249A	.25

(Continued on page 228)

# How "DYNAMIC BALANCING" makes Better Drill Presses



To insure true running of revolving parts, such as pulleys and wheels, Delta uses a special operation known as Dynamic Balancing.

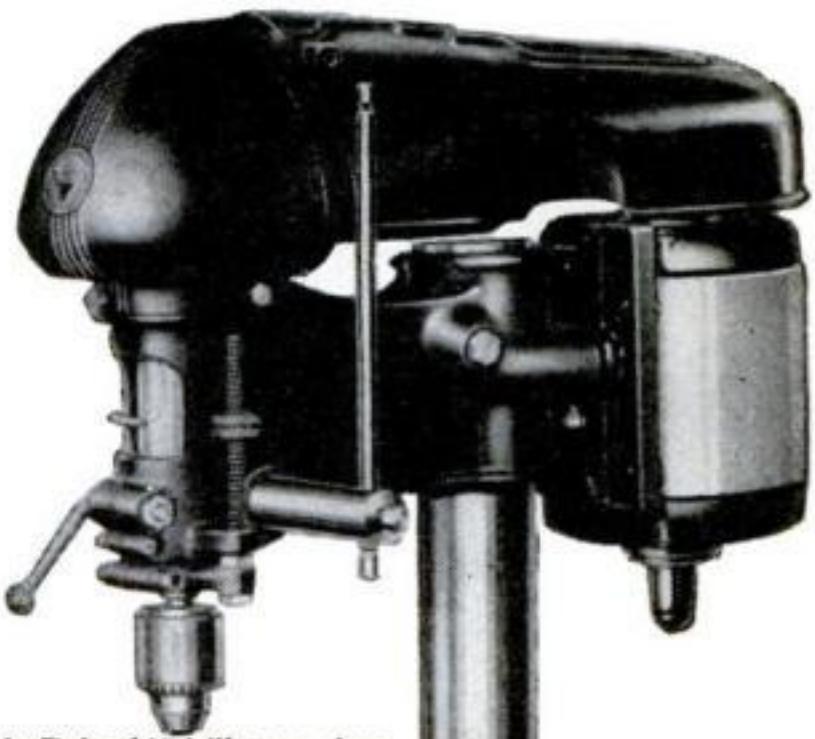
Many drill presses have the pulleys Statically Balanced, a method by which the pulley is mounted upon a shaft and then placed between two horizontal parallel knife edge supports so that the heavy part of the pulley will naturally swing to the bottom. The "heavy" part of the pulley is thus found and by means of a drill the excess metal is removed so that the pulley is better balanced. Static Balancing is not good enough for Delta drill presses because it does not balance accurately enough.

Dynamic Balancing, done with the special delicate electrical apparatus shown in the photograph above, locates and corrects *all* heavy spots—so that the revolving part is in perfect balance.

Therefore, in Delta drill presses you are assured of absolutely true-running, vibrationless operation which means lifelong accuracy for you.

Dynamic Balancing is another Delta feature—an extra, costly operation which is done for you—a feature impossible to see with the eye but one which assures you satisfactory operation when you buy Delta machines.

For the full story of Delta's "hidden quality" send coupon for latest Delta catalog.



Only the Delta 14" drill press gives you the combination of BOTH Self-Aligning Drive and Free Floating Spindle that guarantees accurate alignments. Other features include: "Sealed-for-Life" Ball Bearings; Graduated Quill; Adjustable Depth Pointer; Tilting Table with Index Pin and many others.



Takes drills up to 17/32" in diameter; also all standard wood bits with  $\frac{1}{4}$ " shanks; can be used for boring holes up to 2" with standard multi-spur bits. Can be used for mortising, sanding, routing and grinding.

**SEND FOR CATALOG**

Write for the new Delta catalog which is a complete guide book to power tools. It not only lists the entire line of Delta "Quality" wood and metal working tools—but shows you the important points to look for in all power tools. It illustrates and explains the advantages of the many hidden features of design and construction that make for long, better service in power tools. (Also send for Project Book 8 crowded with new projects, including working drawings, photographs and full instructions.)

**The Delta Manufacturing Co., (Dept. 683N)**  
600-634 E. Vienna Avenue, Milwaukee

Gentlemen: Send me the latest Delta Catalog listing the complete line of Delta Lathes, Circular Saws, Band Saws, Jointers, Scroll Saws, Shapers, Sanders and Drill Presses.  I enclose 10c (stamps or coin) for which please send me the new Delta Project Book No. 8.

Name.....

Address.....

City..... State.....

Check here if you are a Delta user now.

**DELTA**  
**MILWAUKEE**



In all parts of the country, housing for defense workers—both military and civilian—is providing a clear picture of the home of tomorrow. These homes are built by **prefabrication**—the building method by which centralized fabricating plants construct floor, wall, ceiling and roof sections which are later assembled on the building site. Prefabricated homes are comfortable, attractive homes, *livable* in every respect.

Precision-Built Construction leads the field of prefabrication in speed... quality... economy and permanence. *Precision-Built Homes are completed in from 6 to 30 days.* Precision-Built—pioneered in 1935 by Homasote Company—has already been used in \$6,000,000 of architect-designed, *private* homes.

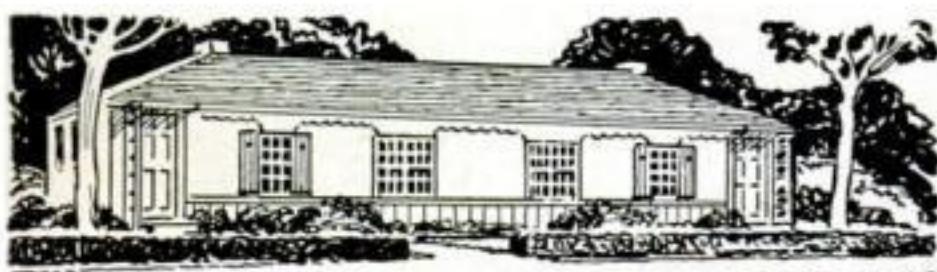
This method features the use of Homasote—the oldest and strongest insulating and building board on the market—in large sheets (up to 8' x 14'). Experience proves these big sheets are essential to satisfactory prefabrication.

Homasote's large sheets eliminate ugly batten strips and wall joints... give you a home snug... easy to maintain... one which requires only the smallest heating plant. With Precision-Built Construction, your home is any size, any style you desire. You have complete freedom of design, using your own architect, or one of our architect-designed plans.

At the end of the present national emergency, 67 fabricating plants throughout the country will service local architects and builders with Precision-Built Construction for private homes. Through this production line method, complete homes—ready for occupancy—will be turned out in one to three weeks.

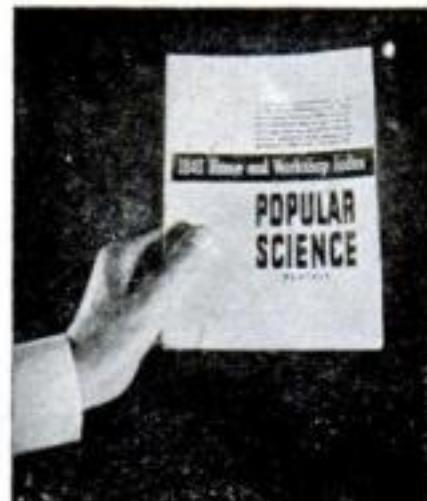


Homasote wholesalers and retailers are cheerfully co-operating with the National Defense Program—at personal sacrifice. Although our capacity is exceeded at the moment by emergency orders, we are rapidly increasing our facilities.



HOMASOTE COMPANY . . . TRENTON, N. J.

## 1941 Home and Workshop Index Now Ready



YOU can save yourself hours of searching through your back issues of **POPULAR SCIENCE** for some desired information by ordering a copy of the Home and Workshop Annual Index, now available for 1941.

Every article on home building, woodworking, craftwork, shop methods, house repairs, model making, radio, automobiles, and the like is not only listed alphabetically, but also carefully and completely cross-indexed. Just send 10 cents to Popular Science Home and Workshop Index, 353 Fourth Avenue, New York, N. Y., and inclose a long, legal-size (No. 10) envelope addressed to yourself. A limited supply of the 1940 Index is also available. Send 20 cents if you wish the indexes for both years.

### Tested Gift Suggestions

*(Continued from page 226)*

#### GIFTS FOR BOYS

Bobsled, 9' 5" long, chassis of spruce and plywood, 362A	.50
Clipper Ship in Bottle, 121-122	.50
Cruiser U.S.S. INDIANAPOLIS, 12" hull, 216	.25
Kayak (with sail, etc.), 192-193-194-R	1.00
Kite Reels, Ball-Bearing, 290A	.25
Projector for Photos and Pictures, 259A	.25
Racing Yacht, 20" sailing model, 48-R	.50
Toy Fire Engine, Sprinkler, Dump Truck and Tractor, can be made of scrap, 101	.25
Toy Lathe, Drill Press, Saw, and Jointer, 113	.25
Treasure Chests, with metal bindings, 78	.25

#### GIFTS FOR GIRLS

Bud-Vase Holder of Metal and Glass, 288A	.25
Colonial Design Doll's House, 72	.25
Doll's House Furniture, 73	.25
Flowerpot Stand (38½" high) and Novel Modern Lamp, 317A	.25
Knitting Bag with Wooden Frame, and Book Ends, 267A	.25
MAYFLOWER, 24" model, 83-84-85-R	1.00
Sewing Kit, Pelican Design, 255A	.25
Turned Costume Jewelry, 275A	.25

#### Popular Science Monthly

353 Fourth Avenue, New York, N. Y.

Send me the blueprint, or blueprints, numbered as follows:

I am inclosing..... dollars..... cents

Name .....

Street .....

City and State .....

(Please print your name and address very clearly.)



### NEW! LIONEL CHEM-LAB

#### A Complete Miniature Chemical Laboratory

Not a flimsy, good-for-a-few-days plaything, but a whole, professional chemical research laboratory in miniature. An abundant supply of the same chemicals that chemists use, the same instruments and utensils PLUS a chemistry text book, in library binding, filled with hundreds of amazing experiments, page after page of pictures and a complete history of chemical progress. Seven Lionel Chem-Labs from \$1 to \$15.

## BIG NEWS FOR LIONEL RAILROADERS

Just out! 64-Page, Full Color Lionel Catalog! New Cars! New Engines! Exciting New Equipment!

Send at once for a copy of the new 1941 Lionel Catalog and feast your eyes on the Lionel line of all time—the greatest array of scale model railroad equipment Lionel has ever manufactured! New, low, long, highly detailed, authentic-model passenger coaches. New engines. New train combinations. New, realistic accessories. New action features. A new high mark in fun, thrills and excitement for Lionel railroaders. Get the complete story. Don't wait. Send for your Lionel Catalog today.

**FREE COPY FROM YOUR DEALER**—You can obtain a Lionel Catalog free from any dealer or department store. Or, mail coupon below, enclosing 10c for postage and handling.

The Lionel Corporation, Dept. AB  
15 East 26th St., New York, N. Y.

Enclosed is ten cents. Please rush the new 1941 Lionel Catalog to:

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

### Lionel "OO" Gauge Railroads

For apartments-dwellers and for all men and boys with limited space in which to work, Lionel "OO" is ideal. Only about half the size of "O" gauge, yet containing just as much fine detail, realism and dependable performance. Read all about "OO" gauge in the new Lionel Catalog. See Lionel "OO" gauge trains on display at your dealers.

# LIONEL

only  
10¢

# 60 Prize-winning PHOTOGRAPHS

*and how they were made*  
[Full Technical Data]

Edited by Willard D. Morgan

Co-Author: *The Leica Manual, Miniature Camera Work*.

This beautiful 64 page booklet brings you the cream of the winners in recent contests and exhibits! Subjects include animals, birds, children, babies, nudes, industrial, landscape, still life, and action-news shots. Every one a prize-winner in its class! Beautiful reproduction prints, with captions giving complete data on camera, lens, filter, film, lighting conditions, exposure, development, etc. In addition, Editor Morgan analyzes each print for its prize-winning qualities, and gives you five essential rules to follow for success in taking and submitting photos in prize contests. This booklet is a gold mine of interest and help for every photographer. Mail coupon now with dime to National Educational Alliance, Inc., Dept. 8012A, 37 W. 47th St., New York.

National Educational Alliance, Inc.,  
Dept. 8012A, 37 West 47th St., New York

Yes, I want "60 Prize-Winning Photographs, and How They Were Made". I enclose a dime.

Name.....

Address.....

## PHOTO ENLARGEMENTS

5¢

Is Photography your hobby? Do you want a profitable easy business at home? Make **PHOTO ENLARGEMENTS** for yourself and others. Your cost 5¢ each and less. The Ideal Photo Enlarger is **AUTOMATIC**. No experience required. Also **COPIES** any picture. \$7.94 **COMPLETE**. Interesting circular **FREE**.

IDEAL-X, 148 West 23 St., New York

ANY SIZE



Carved Hull Kits—Separate Fittings  
Model Yacht Fittings—Sails & Spinnakers

Send 20¢ coin for new 48 page catalog

A. J. FISHER 1002-8 Etowah Ave., S.  
Royal Oak, Mich.

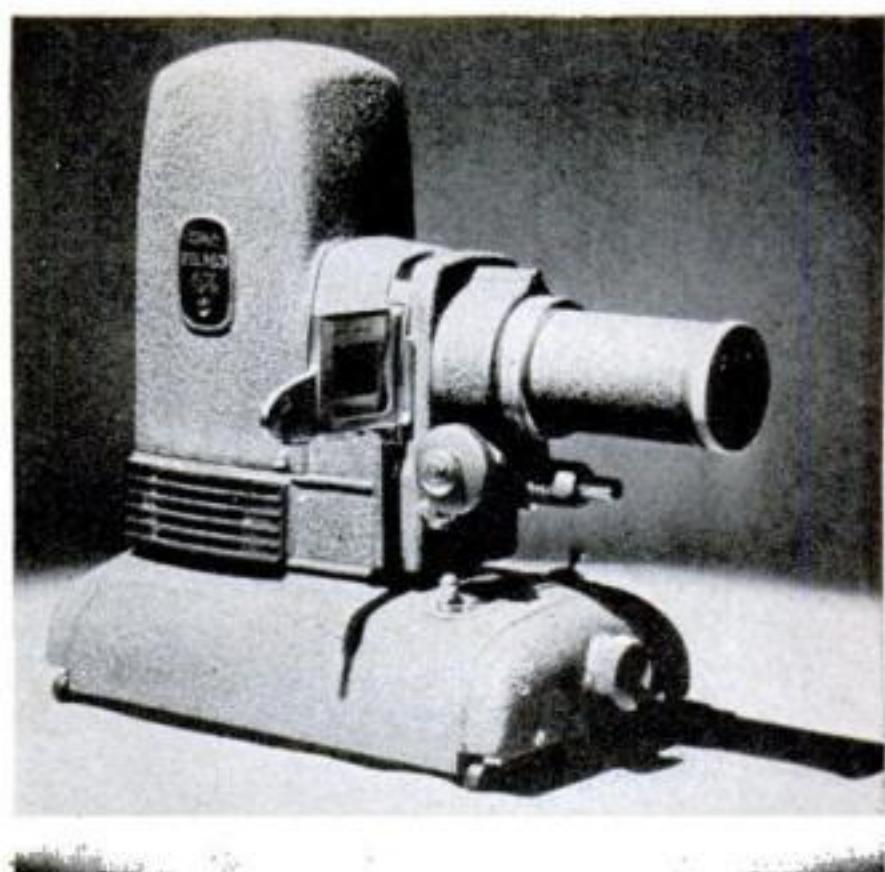
## Filmo PERSONAL MOVIE EQUIPMENT



• There's no compromise whereby fine movies can be made or shown with equipment that side-steps certain standards of design and manufacture. Filmos fully reflect those standards, for most of them were established by Bell & Howell in 34 years of supplying Hollywood's preferred studio equipment. Bell & Howell Company, 1837 Larchmont Ave., Chicago.

PRECISION-MADE BY

*Bell & Howell*



## New Photo-Slide Projector Has Lamp Placed Base Up

WIND-TUNNEL cooling, which is provided by a motor-driven fan, and an especially efficient lamp are features of this new slide projector for mounted 2" by 2" transparencies in color or black and white. The lamp is placed base up in order to keep its sides clear of black deposit, thus avoiding any reduction of light. Lamps of 500, 750, or 1,000 watts may be used, and the projector operates on 100-125 volts, A.C. or D.C.



## Movie Editor's Fading Kit

ODD movie scenes can be joined with smooth "fades" or "wipes" and without abrupt loss of continuity through the use of a kit which contains fading dye and masking tape. The extreme end of the film to be faded is weighted down in a tray, and the end is then lowered slowly into the solution frame by frame. Maximum density is obtained in one minute. Upon removal, the film should be squeegeed with damp absorbent cotton, and immediately rinsed.

# Here's Magic for your Workshop!

WITH just a touch of the finger, Scotch Tape mends, seals and holds—no water required. And it's transparent as glass!

You'll find Scotch Tape just about the handiest helper in your workshop—101 time and trouble saving uses in making and fixing things.

At Stationery, Drug, Department, Hardware and 5 & 10c stores.

Write for **FREE BOOKLET**

Scotch Tape, 900 Fauquier Ave.,  
Department PS121, St. Paul, Minn.



**MENDS:** Torn book pages, sheet music, maps, blue prints, window shades, transparent curtains.



**SEALS:** Packages of all kinds, flaps of envelopes, mothproof bags and boxes.



**HOLDS:** Snapshots in albums, clippings in scrapbooks, shelf paper in place.



**BINDS:** Lantern slides, repairs model planes, fly rods, broken toys, pictures, tears in movie films.



**HOLDS:** Jig saw patterns in place, windings to golf clubs, labels to cans, bottles and drawers.



**25c** with

$1/2 \times 360$  inch  
roll. "Look for the  
name Scotch Tape."

## SCOTCH *Cellulose* TAPE

SEALS WITHOUT WATER — TRANSPARENT AS GLASS

© 1941 Minnesota Mining & Mfg. Co.  
MADE & PATENTED IN U. S. A. BY MINNESOTA MINING & MFG. CO., SAINT PAUL, MINNESOTA. SOLD IN FOREIGN COUNTRIES  
UNDER THE NAME "DUREX" CELLULOSE TAPE. FOREIGN MFG. & DISTRIBUTORS, FOR CANADA — CANADIAN DUREX ABRASIVES,  
LTD., TORONTO. FOR ALL OTHER COUNTRIES — ADDRESS DUREX ABRASIVES CORP., 63 WALL ST., NEW YORK, N. Y.

## Motorcycling... GATEWAY TO

● Harley-Davidson motorcycles play such a vital part in the national defense program that you may have to wait for your dream motorcycle. But a Harley-Davidson with its unmatched performance and dependability is worth waiting for. Plan now for the day when you can own your new Harley-Davidson and join other enthusiastic riders in the world's greatest sport—motorcycling. Talk things over with your Harley-Davidson dealer — he'll tell you the whole thrilling story of motorcycling.



HARLEY-DAVIDSON MOTOR CO.  
Dept. PS, Milwaukee, Wisconsin

Send FREE copy of big 24-page "Enthusiast" magazine filled with thrilling motorcycle pictures and stories. Also literature about the Harley-Davidsons. Stamp is enclosed for mailing cost.

Name \_\_\_\_\_

Address \_\_\_\_\_

**HARLEY-DAVIDSON**  
WORLD'S CHAMPION MOTORCYCLE

# INVENTORS



*"I have a word for you...only!"*

MERLIN M. EVANS  
executive head of one  
of the world's largest  
and oldest firms of  
Registered Patent At-  
torneys.

**W**HEN you place in the hands of an attorney the responsibility of preparing your application for a patent, you rightly expect to get the strongest patent which your invention warrants.

This old established firm of Registered Patent Attorneys offers you those "Extra" services which contribute so richly toward obtaining this desired result. We are able to draw priceless information from our years of practice at the United States Patent Office. Very often we are able to give our clients money-and-time-saving advice based upon our extensive experience. Adequate financial resources enable us to offer you the convenience of deferred payments if you need it. But with all the "Extra" services we provide in our attempt to obtain strong patents for our clients, our fees are quite moderate."

## PATENT and SELL your INVENTION

Now—while millions of dollars are being spent in an immense, high-production program, rich opportunities for men with inventive ideas are unlimited. This firm has prepared for such men, two books which plainly tell how to get protection under the U. S. Patent Laws and how to sell an invention. These books cost you nothing—may be worth many dollars to you. Mail coupon below—today.



**VICTOR J.  
EVANS & Co.**

*Merlin M. Evans*  
REGISTERED PATENT ATTORNEYS

MAIN OFFICE: 430-P VICTOR BUILDING  
WASHINGTON, D. C.

Pittsburgh Office: 521-C Empire Bldg.  
Los Angeles Office: 738-C Security Bldg.

Send me free copies of your books, "Patent Protection" and "When and How to Sell an Invention"—also important "Evidence of Invention" form.

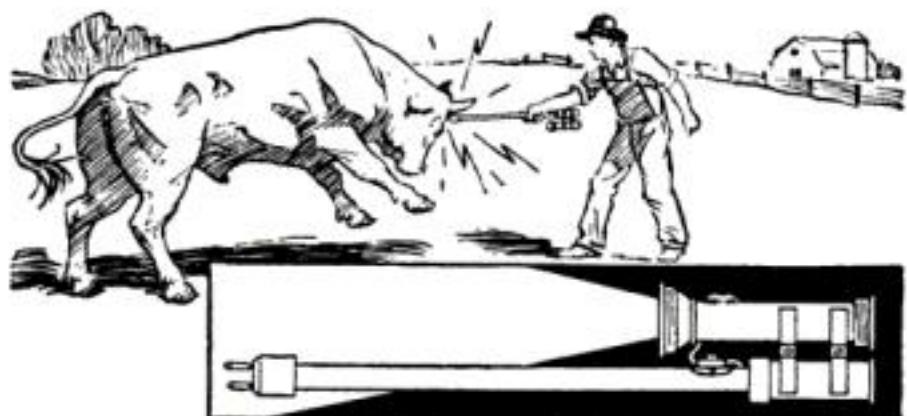
Name .....

Street and No. ....

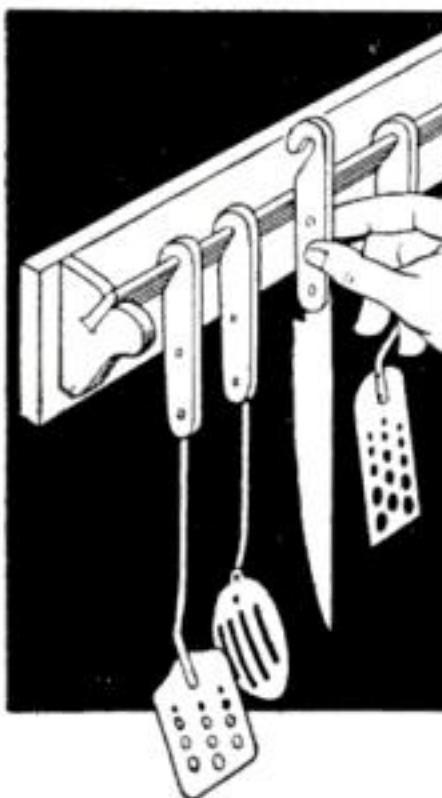
City or Town .....

## With the Inventors

**A**NY FLASHLIGHT becomes an electric prod, capable of keeping angry bulls and other animals at a respectful distance, with the addition of an attachment devised by Sidney F. Andrus, of Troy Center, Wis. His accessory contains a vibrator



and coil, acting together as a transformer, to turn the feeble power of the flashlight cells into a high-voltage shock of 400 to 2,000 volts at the ends of a pair of prongs. Clamps grip the flashlight to form an electric "ground," while the "live" side of the circuit is provided by an insert behind the bulb and a wire leading to the prod through a hole drilled or punched in the flashlight casing. At night, the flashlight provides illumination for use of the prod, which has its own auxiliary switch. . . . DRAWINGS ALONE do not establish an inventor's right to any particular part of a machine, courts hold, if the text of his patent application fails to describe or claim it. . . . KITCHEN UTENSILS cannot swing and clatter, if their handles are of a slotted design worked out by two Connecticut inventors. The slots engage a handy rack of corresponding form, inclined at the same angle of about 30 degrees from the vertical. Objects hung on the rack cannot help being spaced neatly and accessibly, since it is impossible to hang one on top of another. Similar handles and racks are proposed for workshop tools and



other household implements. The design of the handles, the inventors maintain, is the first of its special kind that does not offer sharp edges or otherwise inconvenience the

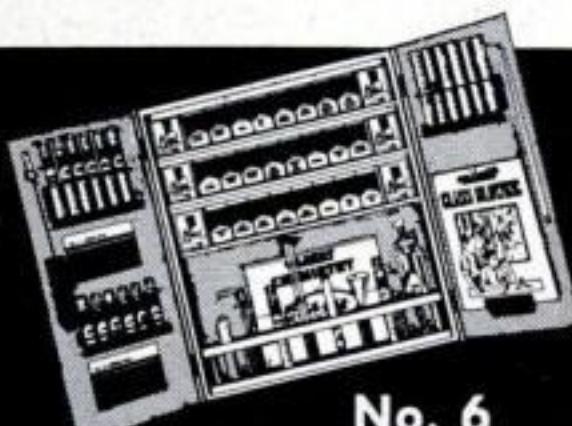
*(Continued on page 235)*

Get a Genuine  
**GILBERT**  
 CHEMISTRY SET  
 The Kind Boys  
 Win Fame and  
 Big Awards With

**\$200.00 ANNUAL  
 AWARDS**

Mr. Gilbert will award \$100.00 in cash to the boy doing what he considers the most important research in Chemistry, Microscopy or Electricity in 1942—and \$10.00 each to the ten boys doing the next most important research. Mail coupon for details. When in New York City, visit the Gilbert Hall of Science, Fifth Avenue at 25th Street.

More boys have won fame and big awards with Gilbert Chemistry Sets than any other kind. Here's why. They are far more than "toy sets," range of chemicals and apparatus is based on real laboratory technique. More sensational experiments in organic, inorganic and electro chemistry. All chemicals and equipment made to Gilbert Hall of Science quality standards. Not 1 manual but 4—in clear boy language by famous American University professors. Big variety and supply of chemicals. Light-proof, non-breakable containers.



**No. 6**

**Double Feature, Double Fun Lab**  
 Big two-door wooden cabinet. Chemicals and apparatus for both chemistry and glass blowing. Generous supply of all chemicals. Two big manuals. Over 400 of chemistry's most spectacular experiments at your finger tips.

**EARNS HONORS AND  
 \$100.00**

Meet Clarence W. Granath—America's No. 1 Boy Chemist of the year. Working in his Gilbert Chemical Laboratory, Clarence developed original experiments that brought him a check for \$100.00.

**FREE**

*"Fun and Action for Boy Chemists"*



24 pages crammed with color pictures. Mail coupon or post card. The A. C. Gilbert Co. (Home of Erector, American Flyer Trains and other Gilbert toys.) 308 Erector Sq., New Haven, Conn.  
 Name.....  
 Street.....  
 City..... State.....  
 Offer good only in U.S.A.

**Triple-Tested!**



This rugged, extra-capacity lathe handles a wide range of materials and sizes for polishing, turning and spinning.

Variable speed drive provides any spindle speed from 260 to 4200 r.p.m., depending upon motor and motor pulley used. Hand wheel and indicator control speeds. Accuracy within all industrial tolerances. Enclosed motor protected against chips and dust. Smooth acting, adjustable tool rest; permanently mounted clamping wrench. Swing over bed 12"; over gap 15½"; distance between centers 38". Floor and bench models.

# WALKER-TURNER MACHINE TOOLS

Approved by  
**HOME CRAFTSMEN  
 INDUSTRIAL PLANTS  
 VOCATIONAL  
 SCHOOLS**

When home craftsmen buy Walker-Turner Machine Tools, they get the same rugged, accurate machines that are serving by the thousands in Defense industries. In aircraft, armament, shipbuilding and other plants, these fast, durable machines are working day and night to speed production of vitally needed parts. Modern volume production facilities are working 'round the clock to make increasing thousands of Walker-Turner Machine Tools available in this hour of America's urgent need.

Drill Presses • Lathes  
 Grinders • Band Saws  
 Shapers • Bench Saws  
 Jointers • Surfacing  
 Jig Saws • Flexible  
 Shafts • Radial Machines

**MAIL COUPON FOR COMPLETE CATALOG**

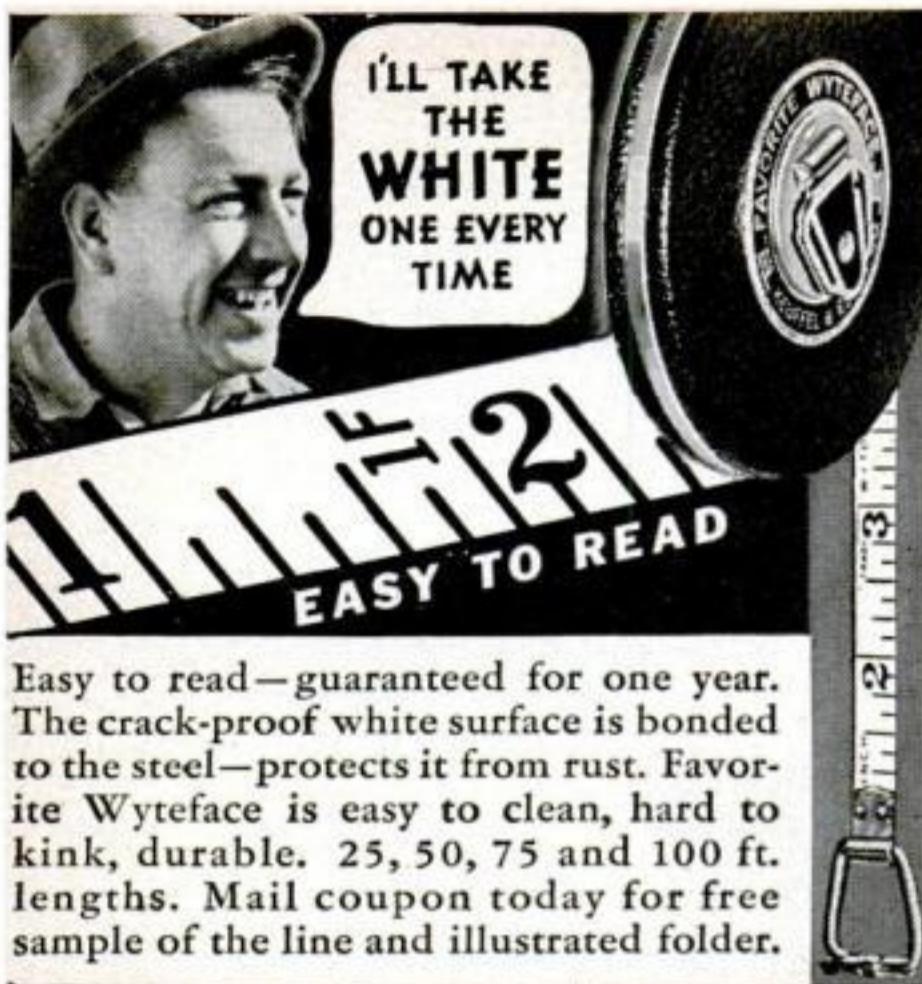
WALKER-TURNER CO., Inc.,  
 2112 Berckman St., Plainfield, N. J.

Send me the free 1941 Walker-Turner Catalog.

Name.....

Street.....

City..... State.....



Easy to read—guaranteed for one year. The crack-proof white surface is bonded to the steel—protects it from rust. Favorite Wyteface is easy to clean, hard to kink, durable. 25, 50, 75 and 100 ft. lengths. Mail coupon today for free sample of the line and illustrated folder.

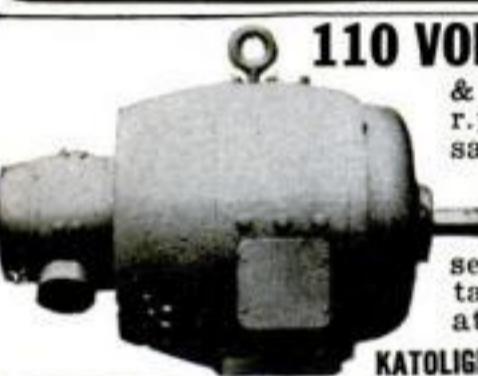
**K & E  
FAVORITE WYTEFACE**  
STEEL MEASURING TAPES

LOOK FOR THIS DISPLAY

KEUFFEL & ESSER CO., Est. 1867  
Dept. 149, Hoboken, N. J.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

**110 VOLT AC LIGHT PLANTS**



& AC generators, 1200 & 1800 r.p.m., furnish AC current same as in city. 350 to 10,000 watts, list \$44.50 & up. Also rotary converters, frequency changers. Diesels, DC motors with AC take-off, AC & DC generators, etc. Write for circulars.

KATOLIGHT, 51 Elm St., Mankato, Minn., U.S.A.

**WINN'S New Idea**

CHEMICAL KITS and APPARATUS OUTFITS for STUDENTS, BIG VALUE. FREE LITERATURE and CATALOG of CHEMICALS & LABORATORY SUPPLIES, SCIENTIFIC BOOKS at BIG DISCOUNT. Send 3c for return postage.

J. H. WINN MFG. CO.  
Dept. 112—124 W. 23 St., N.Y.C.

### Learn Turret Lathe Operation!

Send for the New **TURRET LATHE OPERATOR'S MANUAL**

Offered as the Most Authentic and Complete Text Book on Turret Lathes and Turret Lathe Operation

Every man interested in metal turning—old-timer, learner, apprentice, student—can improve his knowledge and handle tooling setups and metal turning jobs more effectively after reading this authoritative volume. Written expressly for shopmen by men who have spent the greater part of their lives in building, operating, and improving turret lathes and turning methods. Easy to read. Easy to understand. Covers all phases of metal turning. Explains methods. Suggests short cuts. Contains tables on feeds, speeds, tool angles, threads. A de luxe edition sold far below cost by America's largest manufacturer of turret lathes.

## Start Now, MAKING WONDERFUL CHRISTMAS GIFTS THIS EASY, Inexpensive Way!

Send at once for the big, colorful Burgess Handicraft Catalog that shows you how easy it is to make, with your own hands, gifts that will thrill everybody . . . gifts that will look as if they came from the most exclusive shop in town! Yet Burgess materials to make them cost only a few pennies, in many instances.

It's no trick at all to do "professional" work with Burgess Handicraft plans and materials. Everything has been carefully worked out so that you're proficient in "jig time." You can make billfolds, salad bowls, pottery, metal ash trays, costume jewelry, all kinds of decorative boxes, book marks, baskets . . . literally a thousand and one things that will be "individual" and reflect your personality. The big BURGESS HANDICRAFT CATALOG explains everything. It's fascinating just to look through it! To secure your copy, send only 10 cents, coin or stamps. We'll rush your catalog immediately, postpaid. Get this great book NOW! Address as below.

### DADS—MOTHERS:

Ask about our special Christmas Gift Certificate offer



**BURGESS HANDICRAFT SUPPLIES**

178 N. WABASH AVENUE  
CHICAGO, ILLINOIS

**TOOLS OF PROGRESS** 56 PAGES OF WOOD AND METAL WORKING MACHINERY INFORMATION AVAILABLE DUROMETAL PRODUCTS CO. 2651 N. KILDARE, CHICAGO

Now \$5.95  
only



### REAL ENGINE VALUE

The G. H. Q. is a miniature gasoline engine that really operates. Over 15,000 sold in the last year. Now is your chance to buy the New Improved 1942 model kit for \$5.95. ABSOLUTELY COMPLETE with coil, condenser, plug, instructions, etc. Only a screwdriver needed. For boats, planes, midget cars, etc. All parts guaranteed. Send only \$1—Shipped Collect C.O.D. same day. Send for FREE literature or 6c for Jumbo catalog and choice of free wings or aviation pin.

**GHQ MOTORS, Dept. S, 40 East 21 St., New York, N.Y.**

**TURRET LATHE OPERATOR'S MANUAL**

240 Pages!  
Over 350 Illustrations and Drawings  
Only \$1.00 Postpaid  
Elsewhere \$1.50

Operators' Service Bureau of THE WARNER & SWASEY COMPANY • Cleveland, Ohio, U.S.A.

I am enclosing \$\_\_\_\_\_ for an Operator's Manual.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
[D]

**Mail your order**

# With the Inventors

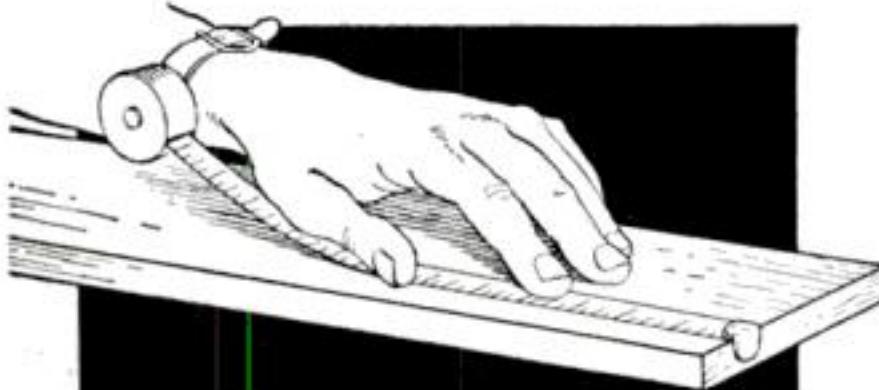
*(Continued from page 232)*

user. . . . ANY SINGLE PART may break without imperiling the occupant, in a safety seat designed for workers in high places by John A. Hoyt, of Glenview, Ill. Resembling a boatswain's chair, his device provides a comfortable perch aloft so that the user can concentrate upon his task, without attention to balance or the numbing effect of pinching ropes. If a supporting member of the seat should fail, the worker's weight is transferred to a safety belt, which normally has a slight amount of slack. The safety belt also helps provide support when it is necessary to lean backward or sideways from the seat. Clips attached to it serve as hangers for tools. . . . ATTACHED TO THE WRIST so that it cannot be mislaid, a flexible rule for carpenters and machinists is always ready for instant use, as shown in the accompanying illustration. When the rule is withdrawn, the case and its strap and buckle take up scarcely more room than an ordinary wrist watch, and a worker may go about other tasks without the slightest hindrance, according to Joseph V. Keenan of Fort McIntosh, Tex., the inventor. The amount of time saved in reaching or hunting for a rule, perhaps as often as 200 times a day, may readily be appreciated. In addition, the convenience of taking exact measurements encourages their use in places



where hit-or-miss methods might otherwise offer a tempting short cut. . . . TO GUARD THE FRESHNESS of coffee and other products that deteriorate upon exposure to the air, an in-

*(Continued on page 236)*



where hit-or-miss methods might otherwise offer a tempting short cut. . . . TO GUARD THE FRESHNESS of coffee and other products that deteriorate upon exposure to the air, an in-

# UNCLE SAM

★ Uncle Sam gets first call ★  
on "Prestone" anti-freeze.  
★ Defense orders are heavy—★  
and the supply is limited.  
Better buy early!

SEE INSIDE FRONT COVER



where hit-or-miss methods might otherwise offer a tempting short cut. . . . TO GUARD THE FRESHNESS of coffee and other products that deteriorate upon exposure to the air, an in-

*(Continued on page 236)*

FIRST  
and  
FINEST

H  
A  
N  
D  
E  
E

**THE PRIZE GIFT**  
For Your Soldier  
Boy, Junior, Dad  
or Grandpa

Tool of 1001 uses.  
Does precision work  
on metals, alloys, wood,  
horn, plastics, bone, glass,  
etc. For your own hobby  
enjoyment or as a gift.

**A WHOLE TOOLSHOP  
IN YOUR HAND**

Uses 300 easy-to-change  
accessories to grind, drill,  
polish, cut, rout, carve, saw,  
sand, engrave. 25,000 r.p.m.  
Wt. 12 oz. Postpaid with 7 Ac-  
cessories, \$18.50 on 10 Days Trial.



Plugs  
in Any  
Socket

MAKES HAMMER-  
SMITHING EASY



FREE: 64-PAGE CATALOG  
ORDER EITHER TOOL ON  
10 DAYS MONEY-BACK TRIAL

With this new tool marvel, any-  
one can now make, for a few  
cents each, valuable articles  
from copper, aluminum,  
pewter, brass or silver, and  
give them a beautiful  
hand hammered finish. A  
fascinating new hobby or  
a means to earn money.

Hammers, surfaces,  
sinks, shapes, forms,  
pierces, engraves, files,  
does repoussé work.  
Plugs in any socket. Wt.  
1½ lbs.

With Accessories, \$29.50  
**Chicago Wheel & Mfg. Co.**  
115 S. Aberdeen St.  
Chicago, Ill.

# Save on Everything in Radio



212  
PAGES

LOWEST PRICES ANYWHERE

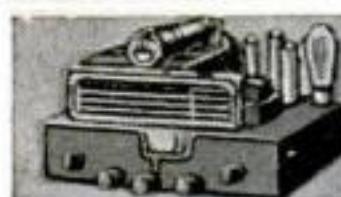
It's completely new—it's sizzling hot—it's got all the money-saving values you expect from ALLIED on Everything in Radio!

## 50 NEW 1942 RADIOS!

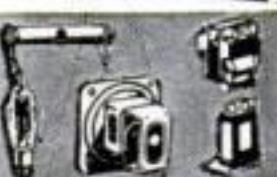
Every one a champion value—"Personal" 3-way Portables; latest FM-AM models; Recorders; Phono-radio Combinations; Plastic models; World-wide models; Auto and Farm radios; new Amateur sets—all at lowest prices!

## NEW 1942 SOUND SYSTEMS!

The latest—for every Public Address application—7 to 60 watts. New features—lowest prices in P.A. See our Time Payment Plan—15-Day Trial Offer. Don't miss these Public Address values!



BUILD  
YOUR  
OWN!

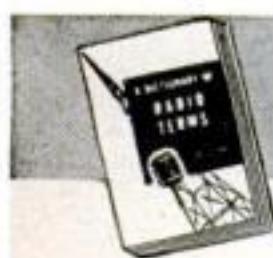


## NEW 1942 KITS!

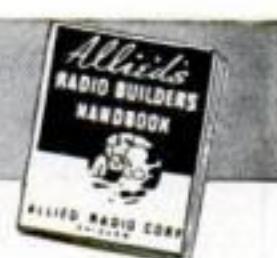
Build your own radio! Everything you need in radio for every building requirement. We'll supply parts lists for any circuit described in magazine radio construction articles. Let ALLIED help you—just ask us—you'll learn quickly. Make us your Radio Headquarters.

## 15,000 PARTS!

The biggest selection of quality parts. Every leading make—complete listings for every radio building and servicing requirement. You can't afford to be without the new 1942 ALLIED Radio Catalog—the reliable Guide to Everything in Radio at lowest Prices!



LEARN  
RADIO!



## RADIO DICTIONARY

Nothing like it ever before—complete, authoritative, worth many times the price! Compiled by leading Radio authorities under ALLIED supervision. Gives easy-to-understand definitions of all commonly used radio terms. A "must" at only.....

10c

## BUILDERS' HANDBOOK

Most popular and widely sold Radio publication—ALLIED's own valuable beginner's book on Radio. Tells how to select circuits, read diagrams, build sets, etc. Fully illustrated. Easy to understand. Order by coupon. It's yours for only.....

10c

## ALLIED RADIO

833 W. Jackson Blvd., Dept. 7-M-1  
Chicago, Illinois

- Send me your FREE 1942 Radio Catalog.
- I enclose 10c for Radio Dictionary.
- I enclose 10c for Radio Builders' Handbook.

Name.....

Address.....

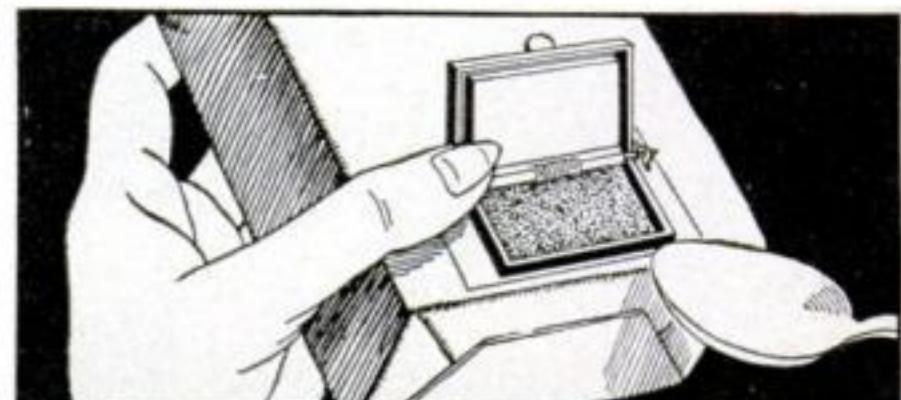
City..... State.....



# With the Inventors

(Continued from page 235)

expensive container has been designed by Morris Landesman, of Brookline, Mass. At one side of a sealed paper carton, he provides a window with a hinged cover, which is raised as shown to remove enough for a serving. When the cover is released, a spring



snaps it back into place, to provide an airtight closure. As packaged, the window cover is held in place by a strip, dated if desired, which is broken by the customer. Once the package is opened, the small exposed area and quick-acting cover hinder entrance of air while the coffee is being used up.... TRAINING PARACHUTE TROOPS by starting them up, instead of down, is proposed as a way to accustom them gradually to the sensations of jumping. Using newly patented apparatus, a novice stands upon a ground platform and dons a parachute, which is inflated by a jet of air from a small standpipe. A longer standpipe, movable in any direction to suit wind conditions, then delivers an air blast that catapults the airman

to any predetermined height. From the air, he sails freely back to earth, without restraint of guide cables. Progressing to higher and higher jumps, he gains confidence in his equipment, and is ready for full-fledged leaps from a plane. The inventor of the training device estimates that a maximum height of more than 200 feet is attainable, using a 100-horsepower airplane motor, a blower of wind-tunnel type, and a Venturi-tube jet which would restrain the girth of the column of air discharged upward. . . .

(Continued on page 239)



To give your ability as a craftsman in wood free rein, follow this proved formula. First check your bench to be sure you have the right saw for every job. Then fill in the missing types—and replace the worn-out or inefficient ones—with Atkins Silver Steel Saws. Made to highest performance standards, they cut straight and true. Their knife-keen teeth stay that way longer. They need less filing. Your hardware dealer has them in a full range of kinds and prices.

**Send 10c for Book  
"HOW TO DO IT"**

Shows efficient shop layouts, with numerous tool suggestions.

**E.C. ATKINS AND COMPANY**  
428 S. Illinois St. Dept. S  
INDIANAPOLIS - INDIANA

# ATKINS SAWS

**SAVE! PRECISION BUILT HOME WOODWORKING MACHINERY NOW AT LOWEST PRICES!**



complete line of accessories, too. Write to-day for big Blue Star Book of precision built equipment . . . the kind you've always wanted to own. See the money-saving prices.

**BLUE STAR PRODUCTS, 512 Rock St., Fairfield, Iowa.**



**USE YOUR BENCH SAW**

With our six in. tool steel cutters. Make moldings, casings, drop-leaf tables, grooves beading & jointing 1" wide \$1.50, 1 1/2" \$1.75. Postpaid. State size hole. List & folder free.

**John A. Sandstrom, Dept. 5, Jamestown, N.Y.**



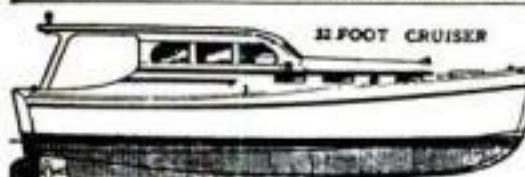
**FUEL SHORTAGE  
—BIG DEMAND  
FOR WOOD**

## TURN TIMBER INTO CASH WITTE LOG SAWS

Start a wood sawing business. Get steady cash clearing land, cutting firewood. One man cuts 15 to 40 cords a day on a little cheap fuel. Make Ties, Fence Posts, Shingle Butts, etc. Use portable engine for other money-making power jobs. Low factory price. Easy terms.

**ENGINES** —Gas, Gasoline, Kerosene. Distillate. Size and style for every need. 3 to 10 H. P. Enclosed; Self-Oiling; Roller Bearing. Low power costs. Write, free catalog.

**WITTE ENGINE WORKS**  
4229 Oakland Ave. Kansas City, Mo.



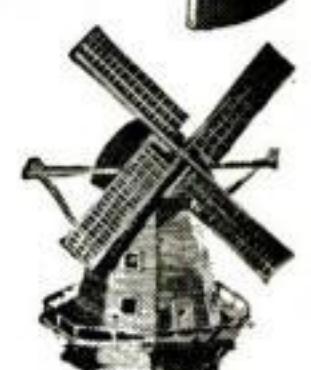
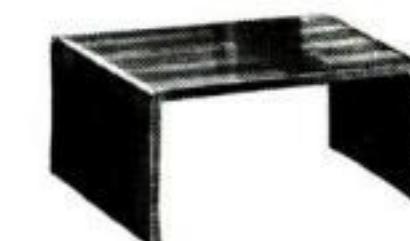
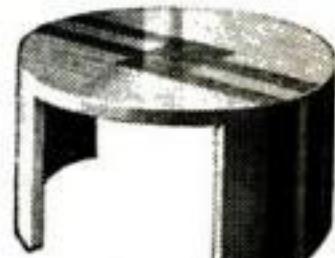
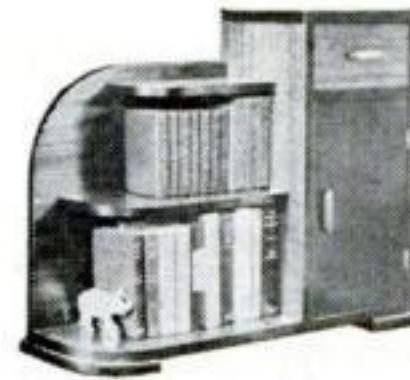
### BOAT PATTERNS

full size, cut-to-shape; and blueprints. Big selection. Low prices. Send 10c (coin) for illust. catalog. "HOW TO BUILD BOATS" book, \$1.00 postpaid. **Cleveland Boat Blueprint Co.** Station A-7 Cleveland, Ohio.

**SIGNS  
AND  
SHOWCARDS** EASILY AND EXPERTLY PAINTED WITH LETTER PATTERNS  
MANY SIZES & STYLES  
WRITE FOR FOLDER

**JOHN F. RAHN**  
1330-33 N. CENTRAL AVE.  
CHICAGO, ILL.

**BUILD  
SOMETHING  
WORTHWHILE!**



Casco projects are sponsored by the makers of these Casco products:



**CASCAMITE** Waterproof Resin Glue, 10c to 85c.



**CASCO** Powdered Casein Glue, 10c to 65c.

## FREE PLANS TO CASCO USERS!

Your choice of detailed building plans for 24 distinctive furniture pieces created by famous American designers especially for home woodworkers.

Each set of plans is available free by using coupon contained in every 25c or larger package of CASCO Casein Glue or the new CASCAMITE Resin Glue.

### FREE! ILLUSTRATED BOOK OF 24 CASCO PROJECTS:

Get the book. It pictures and describes tables, "Unit" chests and cabinets, desks, bookcases, trays, etc. Then choose which fit your workshop and your home. Send for your copy today.



SAVE 2c—STICK COUPON  
ON PENNY POST CARD

**CASEIN COMPANY OF AMERICA, Dept. PS-1241**  
350 Madison Avenue, New York, N.Y.

*Send me a copy of the new, free "CASCO PROJECTS" by return mail.*

Name \_\_\_\_\_

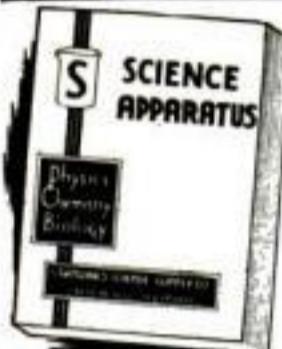
Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

# DON'T WAIT

National Defense requirements have caused a shortage of "Prestone" anti-freeze. Your dealer may not be able to supply you if you wait too late. Buy now!

SEE INSIDE FRONT COVER



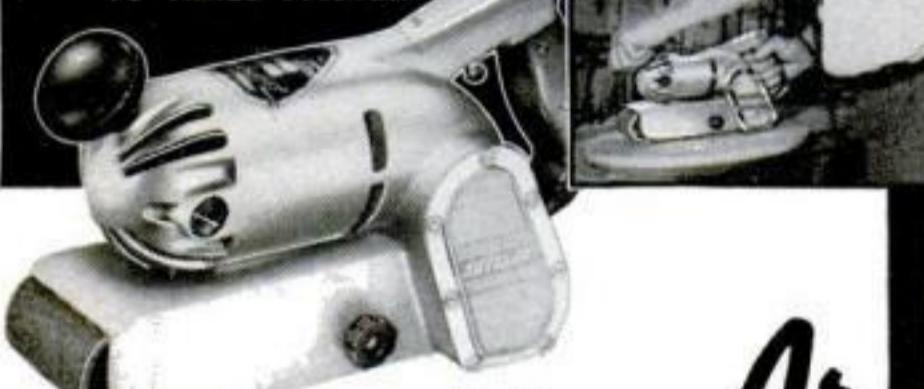
## LABORATORY APPARATUS

Every experimenter should send 25c at once for a copy of our big catalog of Scientific Apparatus and Supplies. It describes microscopes, projectors, laboratory tools, magnets, electrical apparatus, photo electric instruments, batteries, meters, rheostats, sound apparatus, lenses, optical equipment, chemical sets, and scores of hard-to-get items. Buy direct from the manufacturer. Send 25c today for this valuable catalog.

STANDARD SCIENCE SUPPLY CO.  
1230 N. Paulina St. Chicago, Ill.

## Electric Sanding IS FASTER... BETTER... EASIER!

Get smoothest professional finishes in your shop...  
10 TIMES FASTER!



## SkilSAW Zephyrplane Jr. 2 1/4 IN. BELT SANDER

You'll be proud of the satin-smooth finish ZEPHYR-PLANE JR. produces...

delighted at the hours of labor it saves... pleased with its low-cost operation. ENDS tedious "back-and-forth" hand sanding on wood, metal, compositions... on all shop projects, home repairs, furniture refinishing, etc. Removes paint and varnish... polishes. Easy to handle... weighs only 9 1/2 lbs., perfectly balanced for even pressure on entire surface... leaves no ripples or ridges. Link-belt drive. Touch-control lever for easy belt changes. Works from light socket.

SKILSAW, INC., 4777 Winnemac Ave., Chicago

• SEE IT AT YOUR HARDWARE OR MILL SUPPLY DEALER'S  
• OR WRITE US TODAY FOR FULL INFORMATION!

IT COST ME MONEY TO FORGET!

### The "Automatic Memory"

Won't Let You Forget

Mem Index — the famous memory method and personal systematizer, is credited by thousands of successful persons with speeding their rise to the top. Mem Index keeps all data on handy, cleverly indexed and dated cards—today's always visible. Fine leather POCKET CASE organizes your daily memos—handsome DESK TRAY keeps permanent records for you. No transcribing. Worth 1000 times its small cost to salesmen, business and professional men, hobbyists and social leaders. Outfits \$3.45 and up.

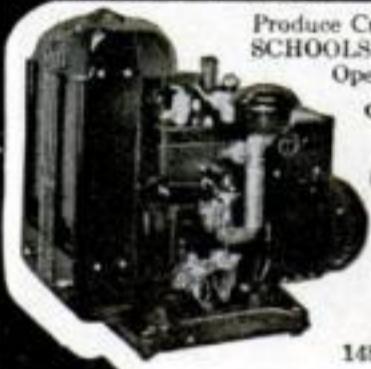
FREE folder tells just how Mem Index saves you time and money and increases your personal efficiency. Now, with business booming, you need Mem Index more than ever before! Write:

Wilson Mem Index Co., 142 St. Paul St., Rochester, N. Y.



Pocket Case

## ONAN ELECTRIC PLANTS ALTERNATING AND DIRECT CURRENT



Produce Current, same as City Power Lines, for FARMS, SCHOOLS, THEATRES, PUBLIC BUILDINGS... Operate Lights, Radios, Motors, All Appliances.

Over 40 STOCK MODELS—350 to 50,000 Watts. Any Voltage—Any Frequency. Combination A. C. - D. C. Types. Manual, Full Automatic and Self-Starting. \$19 up. Shipped—COMPLETE, READY for OPERATION. THOUSANDS IN USE IN ALL PARTS OF THE WORLD

Write for Complete Details.

D. W. ONAN & SONS  
1452 Royalston Avenue • MINNEAPOLIS, MINN.

## The New Plastic Tipped Mallets



will not mar metal or plated finishes—hickory handle, shock proof. Solid brass head threaded on both ends, making the tips replaceable by hand. Send \$1.00 for prepaid sample mallet and price list of various sizes. An ideal Christmas gift.

### SOUTHWEST MFG. COMPANY

1623 E. 1st St.

Santa Ana, California



## PLATING KITS ELECTROPLATE with BRUSH

NICKEL, CADMIUM or COPPER Kits only \$1.50 each. SILVER Kit \$2.00. Thousands in use in workshops and factories! Satisfaction guaranteed or money refunded! (U.S. Pat. Nos. 2061591, 2061592, Can. 368307, 368308). See your dealer or order direct! RAPIDE ELECTROPLATING PROCESS, Inc. 1414-S So. Wabash Ave., Chicago, Ill.

## NEW Grinding Attachment

### For 8" to 16" Metal Lathes. Build It Yourself.

At last, a precision grinder within your means. You save 2/3 by finishing our semi-machined castings, on your own lathe. HURON handles both internal and external grinding. Accuracies to .00025". Mirror finish easily obtained. Grinds valves, pistons, bushings, shafts, hard or soft, holes, lathe centers. Sharpens reamers, milling cutters. Does eccentric drilling, laps; polishes; scores of other uses, for home workshops, garages, machine shops. Write for FREE illustrated folder and price list of supplementary items. Mention your lathe.

Huron Machine & Tool Co., Dept. C, Yale, Mich. Only \$6.45



BUILD  
YOUR  
OWN

## ARC-WELDER

For Light or Heavy Work

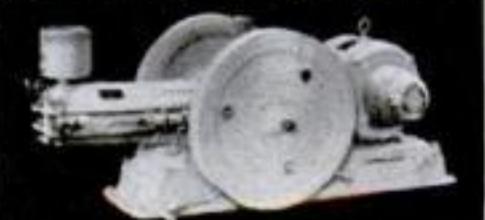
No rewinding necessary—use coils taken from old auto generators. Works on 110 or 220 A.C. Has 20 different heats. Complete plans and Catalog 35c. LEJAY MFG., 3323 Lejay Bldg., Minneapolis, Minn.



Semi-  
Machined  
Castings

## WITTE DIELECTRIC PLANTS

Your present power bill will buy a WITTE that produces power and light for 1c a K.W.H. Save up to 75%. A Size for Every Need. Write today for finance plan, literature and name of dealer.

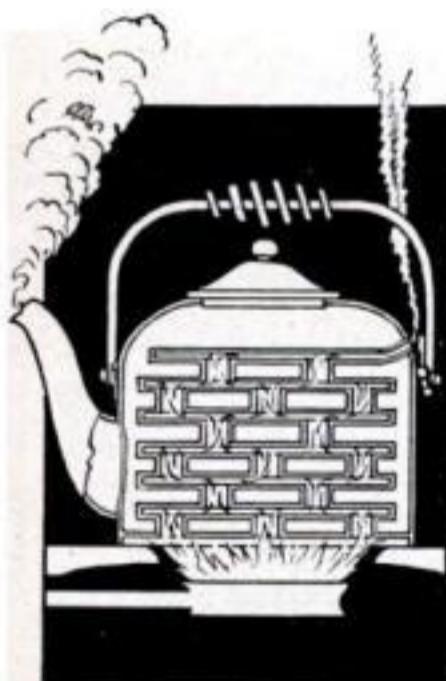


WITTE ENGINE WORKS, 2229 OAKLAND AVE., KANSAS CITY, MO.

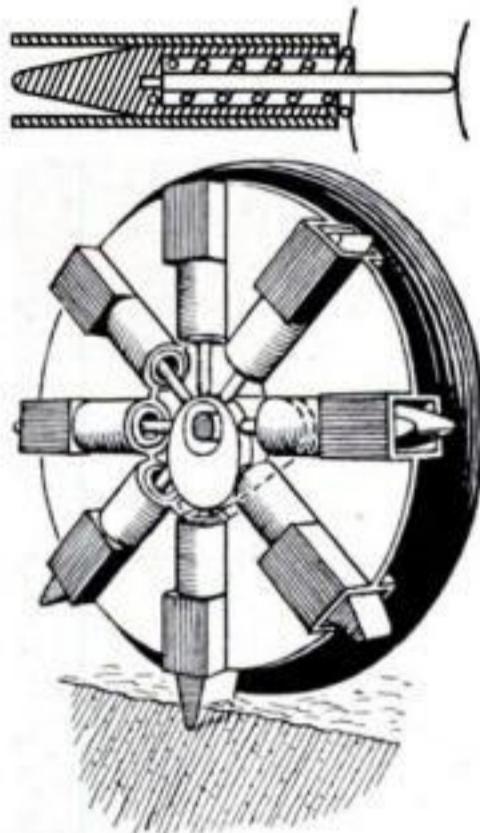
## With the Inventors

*(Continued from page 236)*

EXTRA TRACTION for heavy trucks and farm tractors may be obtained at will, through an attachment for a pneumatic-tired wheel designed by Sam R. Johnson, of Altamont, S.D. Lugs spaced around it are normally held retracted by coil springs. When the going is hard through mucky ground, however, the driver operates a control that sets the lugs in action. One after another, they emerge from their sockets to give a toehold in the earth, and then withdraw at the top of the wheel's revolution. This reciprocating motion makes them self-cleaning. To obtain it, the lugs are forced outward against the tension of their springs by piston rods in contact with a fixed, eccentric cam, as shown in the illustration. . . . BY PATTERNING a teakettle after a fire-tube boiler, Alfred Mazer, of Newark, Ohio, enables a housewife to bring water to a boil in a fraction of the usual time. The utensil also saves fuel by preventing waste of heat from the flame. Not only does the burner play against the base of the kettle, but the hot gases also rise through an interior network of piping. By the time they escape through an outlet opposite the spout, the surrounding water has absorbed a major part of

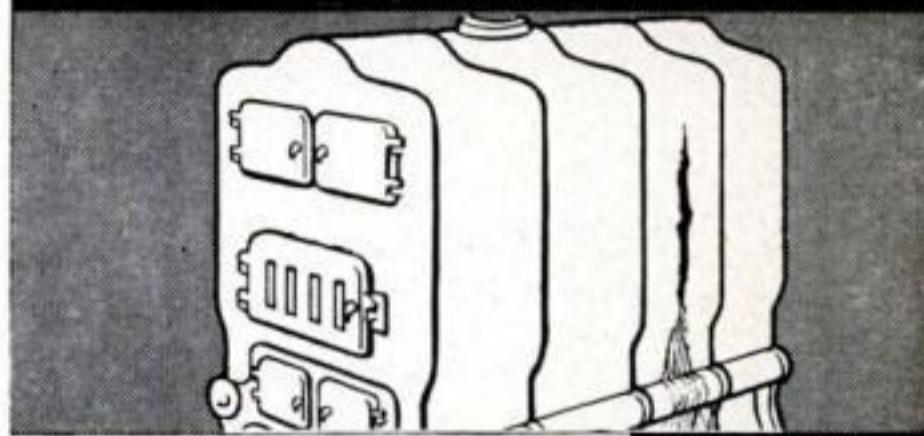


their heat. To remove all chance of burning the hand or wrist, however, the inventor provides a cap that automatically closes the outlet when the kettle is lifted from the stove. As the final touch of efficiency, the rim of the kettle extends below the bottom, confining the flame.



saves fuel by preventing waste of heat from the flame. Not only does the burner play against the base of the kettle, but the hot gases also rise through an interior network of piping. By the time they escape through an outlet opposite the spout, the surrounding water has absorbed a major part of

# SMOOTH-ON SEALS **LEAKS** QUICKLY...EASILY

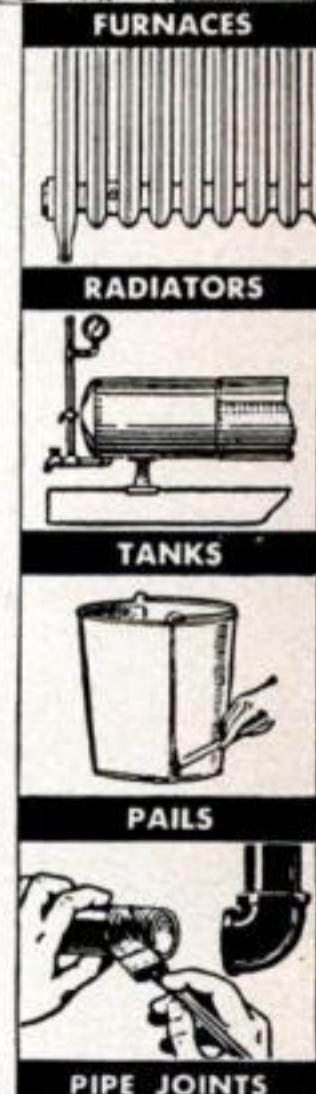


## STOP THOSE LEAKS YOURSELF WITH **SMOOTH-ON**

When a leak develops in any part of your heating or water supply system, Smooth-On No. 1 makes a quick, economical and lasting repair. You can use Smooth-On effectively on many other household repair jobs too—tightening loose machine parts, fixtures, handles, sealing cracks in auto engines, gear housings, crankcases, etc.

### KEEP A CAN HANDY

A necessity in every household. Buy Smooth-On No. 1 in 1 3/4-oz., 7-oz., 1-lb. and 5-lb. cans, at your hardware store, or if necessary from us.



### SEND FOR **FREE** BOOKLET

40 page handbook with 170 illustrations shows how to make lasting repairs quickly, economically.



Smooth-On Manufacturing Co., Dept. 58  
570 Communipaw Ave.,  
Jersey City, N. J.

Name \_\_\_\_\_

Address \_\_\_\_\_

12-41

## *Do it with SMOOTH-ON*

# they watch the atoms dance



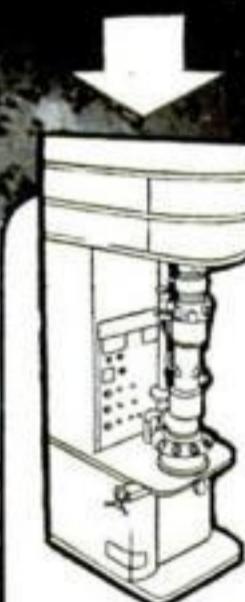
With a new microscope 100 times more powerful than the strongest optical instrument, science can now peer deeper than ever before into the fascinating sub-microscopic world. Based on principles discovered by RCA engineers in their radio-television experiments, the "electron microscope" magnifies up to 100,000 diameters . . . outlines the deadly tubercular bacilli for the first time . . . easily identifies the typhoid germ . . . gets the fingerprints of the streptococcus. Through Popular Science on-the-screen you will be amazed at this sub-world man has never seen before. Don't miss this screen portrayal of one of science's greatest achievements.

Illustration: rubber cement mixed with carbon, magnified 15,000 times. Photo courtesy of RCA.

## popular science on-the-screen



Produced in Magnacolor by Fairbanks and Carlisle with the cooperation of the editors of Popular Science Monthly. Distributed by Paramount Pictures.



Theatre \_\_\_\_\_

Address \_\_\_\_\_

Mail to Popular Science on-the-screen  
353 Fourth Avenue, New York, N.Y.

If this significant issue of Popular Science on-the-screen is not scheduled at your theatre, mail this coupon today.



# ANNOUNCING

THE IDEAL CHRISTMAS GIFT  
NEW 1942

## Twinplex Stropper



\$2 WITH HONE  
\$1.25 WITHOUT

Postpaid

Puts Pleasure in that Morning Shave! Insert any Gillette-type blade in Twinplex—turn the crank for a cool, clean, comfortable shave. America's favorite Blade-Conditioner for 25 years. New 1942 Twinplex features "Barber Strop" rollers, fold-a-way crank, light weight. At Dealers. Order direct if your Dealer is out of stock.



TWINPLEX MANUFACTURING CO.

1800 Roscoe St., Dept. 2412, Chicago, U.S.A.

## HOLD-E-ZEE AUTOMATIC GRIP SCREWDRIVERS

Hold, start and set-up screws in unhandy places. Gripper instantly released by spring action, sliding up out of way when not in use. Finest materials throughout, chrome vanadium blades; many have transparent, insulating unbreakable handles. (Illustrated.)



No more expensive than ordinary screw drivers. Models for recessed-head screws. Handiest ever. Get one today. At auto-supply, hardware or electrical stores.

UPSON BROS. INC.

86 EXCHANGE ST. ROCHESTER, N. Y.



## North Star in a Car IDEAL CHRISTMAS GIFT

The HULL Streamline Auto Compass—accepted guide of modern motorists.

Write for Name of Nearest Dealer

HULL MANUFACTURING CO.,  
P. O. Box 246-E12, WARREN, OHIO



## Minature RAILROADERS

### ILLUSTRATED CATALOGS

HO GAUGE, 32 PGS. .10  
O GAUGE, 112 PGS. .25

MOST COMPLETE AND INFORMATIVE HOBBY LITERATURE, COVERING LOCOMOTIVES, CARS, SCENERY, TRACK WITH IDEAS FOR PLANNING AND BUILDING. GET YOUR COPY TODAY.

W.K. Walthers Inc., 259 E. ERIE ST., MILWAUKEE, WIS.

## BIG FREE RADIO BOOK

Shows hundreds of radio parts, sets, accessories, amplifiers, ham gear, electric appliances and supplies. Rock bottom prices, fast service, guaranteed quality. Send for your copy today. Save at Radolek!

RADOLEK CO., Dept. PS-61, 801 W. Randolph St., Chicago, Ill.



## New IMPROVED Electric MOTO-SAW

New Blade Holder Faces Blade 4  
Ways... Multiplies Capacity

### SAFE AS A HAND SAW JUST GUIDE IT!

More like magic than any tool you ever saw. Imagine an electric scroll saw only slightly heavier than a hand coping saw... a tool that takes no effort to run, no pressure to feed. Works at any angle—on big assembly jobs or on the tiniest piece you can hold in your fingers. Runs 7200 strokes a minute... so fast the blade seems to stand still. Sturdily built... only two moving parts... never needs oiling. Easily cuts intricate designs—so smooth it eliminates sanding. Novice or craftsman, a thrill awaits you when you get a Moto-Saw in your hand.



U.S. Patent 2233862  
Other Patents Pending  
**DREMEL MFG CO.**  
Dept. S121-M  
Racine, Wisconsin

NO LIMIT TO LENGTH OF STOCK IT WILL CUT. SAW TO CENTER OF 19" WIDTHS  
It's fast... cuts on an average of 1 ft. per minute up to  $\frac{3}{4}$  in. medium hard wood. Operates on 110-120 V. 50 or 60 cycle alternating current. If your dealer does not yet have MOTO-SAW, send \$4.85... we'll pay postage. Or send \$1, pay postman balance plus postage. **MONEY BACK** if not delighted after 5 days trial.

# Woodworkers Get this Amazing Catalog of Bargains



HAROLD  
F. HUNT  
President

SAVES YOU MONEY ON  
IMPORTED AND DOMESTIC

## WOODS

Choice Veneers, Plywoods, Inlays  
Bandings—All Kinds of Hardware

Catalog No. 14  
1941 Edition



148 PAGES  
Only 10¢

EVERY WOODWORKER needs this big Bargain Catalog of Woods and Supplies. Send for your copy today. 148 pages—20 color pages, including rare and domestic woods in FULL NATURAL COLORS. Every page packed with unheard of Values in Fine Imported and Domestic WOODS... just in time for Fall and Winter. Rock bottom prices on EVERYTHING you need for making beautiful, useful Wood projects. Includes hundreds of attractive scroll saw patterns, dozens of pages of supplies, equipment and hard-to-find hardware. Up-to-the-second answers to your problems in this amazingly complete Wood Bargain Catalog. It is the woodworker's "Bible".

### Includes Special Beginners' Guide

... tells you how to start and what to make

Deal direct with America's largest supplier of Woods and Wood Working materials for Craftsmen. Finest woods for lathe turning, model making, furniture, decorative novelties. You'll delight in working with the rare woods from South America, Africa, Australia, India and other far-off places. All domestic woods such as Walnut, Birch, Cherry, Holly and Maple in all sizes and veneers, both plain and figured. Huge stocks of plywoods, turning squares, inlay bandings, moldings, carvings, legs, hardware items and tools. Everything at LOW MONEY-SAVING BARGAIN PRICES. Whether you're an expert or a beginner... you need my 148-page 1941 Bargain Catalog No. 14. Send a dime today for your copy. Use the coupon below.

## CRAFTSMAN WOOD SERVICE CO.

2729 S. Mary St., Dept. B-16,

Chicago, Ill.

Harold F. Hunt, President, Craftsman Wood Service Co.,  
2729 S. Mary St., Dept. B-16, Chicago, Ill.

Enclosed find 10c (refundable on my first order) for which please send me your big 1941 Catalog No. 14.

Name.....

Address.....

City..... State.....



## WANT SKIS?

If you have skis in mind for Christmas, be sure to hint for Northlands. Used by most American stars and experts because of finer woods, newer design! Northlands are recognized the world's finest skis.



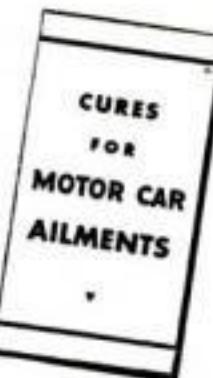
GET THIS 48 PAGE SKI BOOK!  
84 illustrations, edited by Schneider.  
Send 10c or write for FREE folder.

**NORTHLAND**  
World's Largest Ski Manufacturers  
94 Merriam Park — St. Paul, Minn.

## MECHANICS! GET THIS FREE BOOK TODAY!

"Cures for Motor Car Ailments" is the book mechanics go for—72 pages of useful information for fixing cars. Write today for free copy.

**CHAMP-ITEMS, INC.**  
6200 Maple Ave., St. Louis, Mo.



## SAW-FILING

Pays up to \$2 or \$3 an Hour

A FOLEY Automatic Saw Filer files hand, circular and band saws better than the best hand filer. Cash business, no canvassing, no eyestrain. No experience needed. "Bought a Foley, one year later had all debts paid and \$400 on a new home. Many days I earn as much as \$16." — J. H. Kellogg. Send coupon for FREE PLAN, no obligation.

FOLEY MFG. CO., 1219-1 Foley Bldg., Minneapolis, Minn.  
Send Free Plan on Saw Filing business.

Name.....

Address.....



## WOODWORKERS

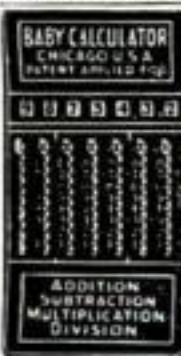
**1941 MASTER MANUAL**

Get the Brand New Constantine Master Manual for Woodworkers and Big 1941 Bargain Book, listing and describing over 100 different kinds of wood and 980 different items in veneers, lumber, panels, inlay work, turning squares and helpful woodworking tools. All at big money-saving prices. Indispensable to expert or beginner. Printed and illustrated articles on How to Make Inlaid Pictures; How to Make Veneered Panels; How to Finish Different Kinds of Woods. A source of supply for you in any quantity—large or small—every kind of wood you are looking for. Send 25c today in stamps or coin. 25c refunded or credited on first order, so Manual costs you nothing.

ALBERT CONSTANTINE & SON, INC. 793-A East 135th St., N.Y.C.

**WORLD'S LOWEST PRICED ADDING MACHINE** **IDEAL XMAS GIFT** **GUARANTEED ACCURATE**. Not a toy. Operates with only a finger flick. Adds, subtracts, multiplies, divides. Counts up to ten million. Pays for itself over and over. Ideal Gift for Business, Income Tax and School use. MONEY BACK GUARANTEE. Address. Pay Postman only \$2.50 plus postage. (Send full cash if outside U.S.) Money back in 10 days if not delighted. AGENTS WRITE.

**CALCULATOR MACHINE COMPANY (Mfrs.)**  
DEPT. 413, P. O. Box 1118, CHICAGO, ILLINOIS



"WHIZZER" Bicycle Motor. Quiet, Dependable, 4-cycle 1 1/2 h.p. Bicycle structure not weakened. Center of gravity unchanged. Looks like motorcycle. Easily installed. Further information write Whizzer Sales or send \$59.95 for immediate delivery.

**WHIZZER MOTOR SALES CO.**  
9000 Sunset Blvd. Los Angeles

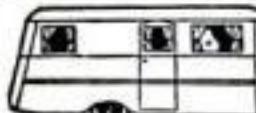
## Use ARCADE POWER TOOLS



### EASY-TO-AFFORD PRICES

Arade Tools give home craftsmen the advantages of fine shop equipment at easy-to-afford prices. Every tool is scientifically designed and precision built to assure accurate workmanship and long, faithful service. The Arcade line includes practically all types of Bench Tools, Model Makers and Accessories. Write for Free Catalog and Price List.

Arcade Mfg. Co., 1218 Shawnee St., Freeport, Ill.



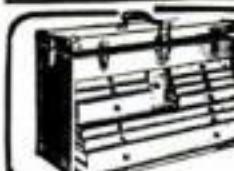
### FREE TRAILER PARTS CATALOG

We'll save you money on axles, springs, wheels, couplers, windows, sinks, water pumps, brakes, refrigerators, beds, lamps, inside and out, 6V lamps, furniture, jacks—everything. Special discount to mfrs. **NATIONAL TRAILER EQUIPMENT CO.** Successors to Kar-A-Van Industries, Inc. Dept. 5-5-714 W. Wisconsin Ave., Milwaukee, Wis.

### OWN A Printing Business



Cards, Tickets, Stationery, etc. Good profit in spare time. **PRINT YOUR OWN** greeting cards, movie titles, church work, etc. Save money. Easy rules supplied. **Junior Press \$8, Senior Outfits \$16 up.** Have home shop. Raised printing like engraving too. Sold direct from factory only. Write for free catalog and all details. **KELSEY, INC. X-33, MERIDEN, CONN.**



### GERSTNER Tool Chests

Machinists and Toolmakers—choose from free catalog, and suggest it for Christmas or for any other occasion.

**GERSTNER TOOL CHESTS** 541 Columbia St. Dayton, Ohio

### 10 NEW SETS OF STANLEY PLANS

Each set includes five interesting things to make. Complete details.



Typical  
Plan from  
Set No. 1  
Hanging  
Shelf with  
Drawer

Set No. 1	Hanging Shelves . . . . .	10c
Set No. 2	Lamps . . . . .	10c
Set No. 3	Trays . . . . .	10c
Set No. 4	Tables and Stands . . . . .	10c
Set No. 5	Book Ends and Small Articles	10c
Set No. 6	Flower Pot Holder and Desk Articles . . . . .	10c
Set No. 7	Mirrors, Footstool and Table . . . . .	10c
Set No. 8	Magazine Stands and Tables . . . . .	10c
Set No. 9	Chests and Boxes . . . . .	10c
Set No. 10	Smokers' Stands . . . . .	10c

Select the sets you want; send check, money order or stamps to

### STANLEY TOOLS

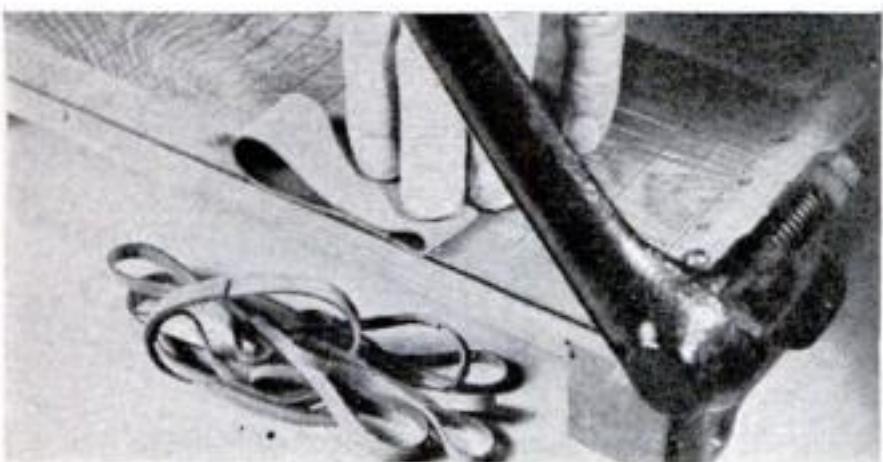
DIVISION OF THE STANLEY WORKS

2612 Elm Street, New Britain, Conn.



## Pipe Cleaners Find New Use as Child's Hair Curlers

PIPE cleaners are used for many purposes besides the one for which they are sold—cleaning and dusting small mechanisms, applying soldering paste or acid, glue, and other liquid preparations to small work, touching up damaged spots and small parts with paint or enamel, and so on. Here, however, is a use that no mere man would be likely to think of. Because they are very light and soft, pipe cleaners make excellent curlers for children's hair. They are used in the same manner as the regular, but heavier, wire curlers.—MRS. RUTH SWALLOW.



## Old Inner Tube Supplies Special Rubber Bands

IT IS sometimes difficult to obtain rubber bands in special widths and lengths, but they can easily be made by cementing the ends of a sheet of inner-tube rubber to make a tube of the required diameter. The individual bands can then be neatly cut with the aid of a print trimmer.—G. S. G.

# WHATEVER YOU MAKE — Whenever You Repair



10¢-25¢-50¢-85¢

## Glue it with **WELDWOOD**

Your homecraft projects, models, mending jobs, deserve WELDWOOD, *the glue of the aircraft industry*. There is none finer for your purpose.

You want joints as strong as the hardest wood—dowels that won't loosen or pull out—inlays, marquetry, overlays that become an integral part of the project—so stick to WELDWOOD.

WELDWOOD one part Plastic Resin GLUE is cold setting, quick mixing, ready for instant use. Once set, it is entirely WATERPROOF, even when submerged in fresh or salt water. ROT-PROOF—bacteria cannot survive in a WELDWOOD joint. Not affected by steam heat or dampness. STAINFREE.

Try WELDWOOD GLUE on your next job, and you'll stick to WELDWOOD in the future.

### UNITED STATES PLYWOOD CORP.

World's largest producers of Plywood

616 WEST 46th STREET, NEW YORK, N. Y.

If your hardware dealer can't supply you send coupon below.

# WELDWOOD PLASTIC RESIN WATERPROOF GLUE

United States Plywood Corp., N. Y.

Enclosed find 25¢ in coin for which please send post paid generous can of WELDWOOD GLUE and complete free GLUE MANUAL.

Name.....

Address.....

(My dealer is.....)

# FIRST COME

It's first come—first served—as long as dealers' supplies of "Prestone" anti-freeze last. National Defense needs have created a shortage. Buy early!

SEE INSIDE FRONT COVER

## QUICK-READING BLACK FIGURES ON WHITE TAPE



Now  
\$2.10

Avoid errors use MASTER BRITE-BLADE—the easy-reading steel tape. Heavy, white, crack-proof surface protects tape against rust—cleans instantly—prolongs useful life of tape. Unbreakable metal case, push-button lock (optional) retains readings; smooth sliding, replaceable, white blade are features that make BRITE-BLADE your first choice. MASTER wood and steel tape rules are made for all kinds of work. MAIL COUPON TODAY.

## MASTER RULES AND TAPES

Master Rule Mfg. Co., Inc., Dept. D, 815 East 136th St., New York, N. Y.

I enclose \$\_\_\_\_\_ for  MASTER BRITE BLADE with spare blade for each to be sent postpaid

Co. Name \_\_\_\_\_

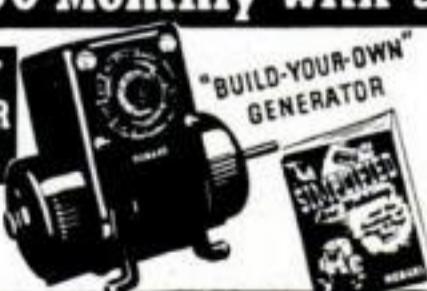
Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

"Make \$150 to \$300 Monthly with 'Simplified' Arc Welding."

With this Hobart generator, a used auto engine and chassis, you can build your own portable gas drive arc welder at a savings of from \$300 to \$500 over complete factory built equipment. With this welder you can go anywhere to get the profitable emergency repair and construction jobs.

TRY IT  
ON YOUR  
WORK



It's easy to get the big pay jobs that bring in real profits! Hobart Arc Welders are simple to operate, weld faster and guarantee better quality welds. Pay for your welder in a short time out of extra profits. Write for details. **FREE!** This valuable book telling all about new profitable welding applications. Write today!

Hobart Bros. Co., Box P-121, Troy, Ohio

## MOTORISTS Wanted!

### TO MAKE THIS UNIQUE GAS SAVING TEST



#### FITS ALL CARS

Constructed of six parts fused into a single unit, adjusted and sealed at the factory. Easily and quickly installed by anyone in a few minutes.

**FOR INTRODUCING.** Here's a splendid opportunity for unusual sales and profits. Every car, truck, tractor owner a prospect. Send name and address now for big money making offer and how you can get yours Free. The Vacu-matic Co., 7617-624 W. State Street, Wauwatosa, Wis.

## AGENTS Get Yours FREE



## BUILD A MOSQUITO BOAT!

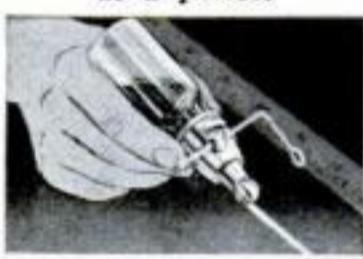
CARVED HULL INCLUDED! Famous Ideal 12 1/2" Super-Detail model. Perfect building easy with our complete kit. \$2.50, p.p. (Catalog 10c) IDEAL MODELS, 28 W. 19 St., NEW YORK

## PAINT STRIPING TOOL

Try it! See the Added Beauty

ONLY  
\$1.00  
POST  
PAID

As easy to use  
as a pencil



Every Painter and Craftsman Should Own One

Send for your tool today. Use it. If you are not satisfied that you have added character as well as beauty to your work, return the tool and we'll refund your money promptly.

Dealers: Write for literature, etc.

**WENDELL MFG. CO.**  
2543 N. Ashland Ave. Chicago, Ill.

## MOTOR DRIVEN Flexible SHAFT TOOL

at only  
\$14.95

WITH PENCIL-SIZE HANDPIECE for "FINGER-TIP" CONTROL

Win real pleasure and profit by using a FOREDOM FLEXIBLE SHAFT TOOL. Performs countless tasks quickly, efficiently, effortlessly in home or shop on wood, metal, glass, plastics, etc. . . . Sensitive "Finger-tip" control, easy accessibility, unobstructed view. You can grind, polish, mill, engrave, sharpen, slot, saw, carve, clean, sand, etc. Ideal for glass etching, gem-setting and finishing dies, molds, castings etc. Complete Portable Workshop, including 50 piece accessory set, \$16.15. Order today. **FREE**, New Complete Catalog.

FOREDOM ELECTRIC COMPANY  
DEPT. 271, 27 Park Place, New York

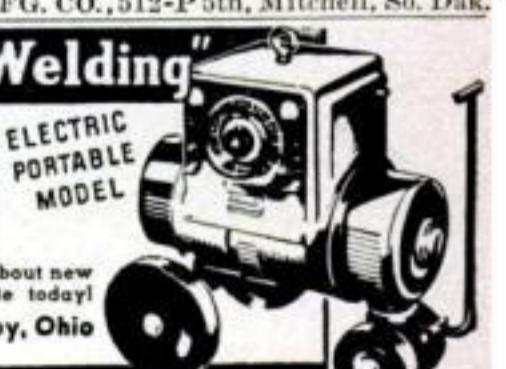


**FOREDOM** For a Truly Useful  
Gift this Xmas!

## NEW CHEAP OIL BURNER

FOR COOKING & HEATING STOVES-FURNACES  
HEAT YOUR HOME, COOK YOUR MEALS  
WITH CHEAP FURNACE OIL

LIFE-TIME GUARANTEE AGAINST DEFECTS.  
NO MORE SHOVELING COAL OR ASHES.  
New Fuelizer Starter Vaporizing System turns Cheap 130 Flash Furnace Oil into Oil Gas heat without clogging up. **\$1.00-BONUS OFFER FOR TESTING.** Big profits. We will let you try it in your own stove or furnace for one month. **Get Yours FREE** for introducing. Be first. Send in your name today. NORTHWEST MFG. CO., 512-P 5th, Mitchell, So. Dak.





Get acquainted with fast-shaving, money-saving Marlin Blades today!

DOUBLE EDGE  
20 FOR 25¢

Single Edge  
15 for 25¢

**Marlin** HIGH SPEED BLADES

GUARANTEED BY MARLIN FIREARMS CO.—FINE GUNS SINCE 1870

**ACE**  
LATHE TOOL SET

\$14.50



Be permanently tooled-up for every operation on your Metal Cutting Lathe

The ACE Set is complete—there's nothing more to buy. Drop forged by the manufacturers of cutting tools used by 96 per cent of the plants and shops in industry they are correctly designed, are of special steel, are finely finished, are stronger—will last a lifetime. You can cut easier, faster and more accurately with ACE TOOLS.

At your Hardware Store—Circular FREE.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

329 N. Francisco Ave., CHICAGO, U.S.A.

3 Turning Tools, 2 Cutting Tools, Knurling Tool, Boring Tool, Threading Tool, High Speed Steel Cutters and Blades, and 2 Wrenches in Fitted Steel Case.

**BARRON** ROTARY WOOD PLANER • PLANES • PANELS

RABBETS • ROUTS • TENONS •

FITS ANY DRILL PRESS

\$7.50 READY TO USE

A precision safety tool. Planes to agate smoothness. Eliminates need for high priced planer or jointer.

Fits any  $\frac{1}{4}$  h.p. or larger drill press. Indispensable. Thousands in use. At your dealer—or write for literature. Shipped prepaid on receipt of \$7.50. Positive money back guarantee.

BARRON TOOL CO., 355 Architects Bldg., DETROIT, MICH.

**BIG 7 FOOT GLIDER**

Easily built, beautiful Class E  
CLEVELAND CONDOR

Complete \$1  
Kit only

• 48" Eaglet (Baby Bowline type) Soaring Glider, only 50¢.  
• Send 5¢ for latest Cleveland catalog of "America's FIRST LINE of Model Airplanes" featuring Gas, Rubber, Stick, Gliders, etc.

CLEVELAND MODEL & SUPPLY CO., INC., 4508A 118 Lorain Ave., Cleveland, Ohio

SCREW-IN PLUG

ATTACH RING

AGENTS

Send name for facts on most sensational money making product of the decade.

**New FLUORESCENT**

Screws Into Socket Like Ordinary Bulb

PRICES as low as \$3.55 including tube—No "installation" or special wiring—screw in and light; these LITE-KING Features now open up fabulous sales to stores, offices, factories, homes—of sensational genuine FLUORESCENT Lighting. Three Times the Light—Like daylight. Saves its own cost in current use. Rush name for facts. All free.

NAMCO, Dept. 712, 433 E. Erie St., Chicago, Ill.

27,000 R.P.M.

**MOTO-TOOL**



Modern Craftsman's Kits  
KIT NO. 1 with 23 high grade accessories and Model 1 Moto-Tool in hardwood case. \$17.50  
KIT NO. 2, same as above with Master Model Moto-Tool. \$23.50

THE GIFT  
HE'LL LIKE Best  
AND USE  
Longest

The genuine Dremel Moto-Tool is the ideal gift for a craftsman's Christmas. Grinds, polishes, sharpens, drills, engraves, etc., etc. Saves time, cuts cost, does finer work. Owners find it the handiest tool in the home or shop, use it daily. Same tool as used on precision jobs in factories. Over 25,000 r.p.m. (the speed necessary to conserve cutters, do fine work). Has oil-less (oil-sealed) bearings...dynamically balanced armature, vibrationless. 110 v. universal (AC-DC) . . . has built-in cooling fan.

6 oz. Model 1 Moto-Tool complete with chuck and  $\frac{1}{8}$ " collet, only \$9.85. Master Model 2, faster, heavier, more powerful, with chuck and  $\frac{1}{8}$ " collet only \$16.50.

**10-DAY TRIAL—Money-Back Guarantee**

See genuine Dremel Moto-Tools and complete kits at better dealers or order direct from factory on 10-day money-back trial. Send only \$5.00 with order. We ship C.O.D. for balance.

DREMEL MFG. CO., Dept. T-121-M, Racine, Wis.

**Sensational NEW**

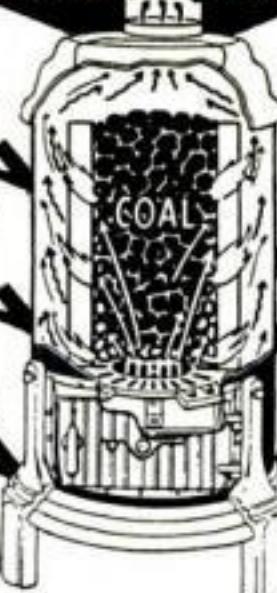
**WARM MORNING**

**Coal Heater**

Start a Fire  
But Once a Year

Holds 100 Lbs.  
of Coal

Reduces  
Heating Costs



Heats All Day  
and Night  
Without  
Refueling

No Clinkers

Semi-Automatic  
Magazine Feed

Unless it's a  
LOCKE it  
isn't a genu-  
ine WARM  
MORNING.

Look for the  
"LOCKE"  
under feed  
door. No other  
manufacturer  
is licensed to  
use these  
patents. Name  
registered  
U.S. Pat. of-  
fice, Mfg. un-  
der U.S. Pat.  
No. 2,255,527

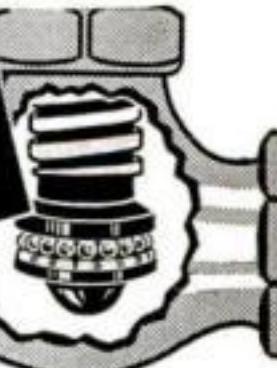
Model 120A shown  
at right. Note how  
coal feeds down of  
its own weight.

• Nothing else like it! Patented construc-  
tion gives amazing results. Burns any kind  
of coal, coke, briquets or wood. No clinkers,  
only fine ash. Wake up in WARM home every  
MORNING. Sold by 18,000 leading dealers.  
Write now for free illustrated folders (C-5).

**LOCKE STOVE COMPANY**  
Dept. 7, 114 West 11th St., Kansas City, Mo.

**LOCKE**  
**WARM MORNING**  
★ **Coal Heater** ★

**Stop DRIPPING FAUCETS with WATER MISERS!**



Eliminate  
drain on your  
purse and  
strain on your  
nerves. Ball Bearings end friction—save  
rubber and water for defense.

Non-rusting. Longest wear by tests. Fit all  
compression faucets. Install like regular wash-  
ers. Cost only 25c each. Replacement caps 10c.  
Write or mail coupon below under money-back guarantee.

**ECONOMY VALVE CO.**

711 Fifth Ave.,

New York

Please send me post paid test order of 4 Ball Bearing Water Misers (2 Kitchen Faucet Size; 2 Bathroom Faucet Size).

\$1. Enclosed  Send C. O. D. \$1.20.

My money is to be refunded if I am not fully satisfied (20¢ extra on C. O. D. covers postage collection charge).

NAME.....

STREET.....

CITY..... STATE.....

**100 TOOLS  
IN ONE**

MASTER  
MODEL  
\$16.50



WRITE FOR

**FREE  
CATALOG!**



Fix your crippled furniture, chipped veneer, splintered moldings so they look like new . . . Rogers Glue stays put longer because it's stronger . . . also useful for repairing sporting goods, leather, cabinet work, wooden drawer pulls, interior building construction, and the like.

**Special Offer!** Sells 10 cents and up in tube, jar or can at hardware stores only or send 10 cents for full-size jar, a free project book giving new ideas, new plans on how to make useful articles, plus a free set of project sheets.

ROGERS GLUE CO.,  
Department M, Gloucester, Mass.

# ROGERS

A TON OF STRENGTH IN EVERY DROP



# Power King

WOODWORKING TOOLS OF TESTED QUALITY

## 10"-12" LATHES



**Suitable for Light Metal Turning**

Point for point, top value for your money! SKF ball bearing equipped. Strongly built for heavy duty work. And look at these prices: 10" \$29.95, 12" \$37.50. See catalog for other important features.



POWER KING TOOL CORP., 1207 Cleveland St., Warsaw, Ind.  
Please send catalog. I am interested in  7",  8" Saws  
 Jig Saws  Wood Lathes  Drill Presses  Spindle Shapers  
 Jointer Planers  Belt and Disc Sanders.

Name.....

Address.....

City and State.....

Please mention POPULAR SCIENCE when writing to advertisers.



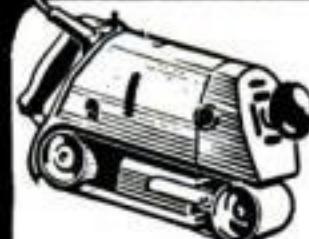
only \$7.25  
postpaid

(Outside U.S.A. \$7.75; C.O.D., \$7.50)  
FREE CATALOG! describing  
complete line: Jig Saw, \$1.75;  
Shaper, \$3.25; Circular Saw with  
oilless bearings, \$3.50; Drill  
Press, \$2.75; Sander, \$1.10; com-  
pletely equipped lathes, \$2.25 and  
\$5.40. Sold direct only. Order  
today or send card for Catalog.

"The  
Joint-  
maker"

AMAZING VALUE  
Just think of it, a real 4"  
power jointer at this low  
price! "The Jointmaker" per-  
forms every joint-making opera-  
tion (planes, cuts angles, etc.)  
smoothly and quickly. Weighs 8  
lbs.; is overall 4 1/2" high by 8 1/2"  
wide by 13 1/2" long; has 4 1/2"  
wide table with 4" tempered car-  
bon steel knives set in solid  
safety-type cylinder with guard.  
Fence fully adjustable with guard  
tools. Frame and legs solid cast  
iron. A J & H Metal Product.  
TAYLOR-SHANTZ, INC., 3 Commercial St.,  
Rochester, N. Y.

## SANDS 10 Times Faster...



New **Guild** PORTRABLE  
ELECTRIC **Sander**

Now, do better sanding this easy  
way—10 times faster! This sturdy,  
portable belt sander turns out expert  
work in minutes—instead of hours of  
hand-sanding drudgery.

Give everything you make that expert finish. Works  
on wood, metal, stone, plastics. Sells at popular price  
—weighs only 9 pounds. Fully guaranteed. Try it at your  
hardware dealer's, or WRITE us today for full details.  
SYRACUSE GUILDTOL COMPANY, 1741-12B No. Salina St., Syracuse, N. Y.

## WORLD'S SAFEST SAW!

\$12.75  
In U.S.A.



SYNCRO cuts 3/4" soft, 1/2" hard wood, thin metal,  
plastics—smoothly, quickly, safely. 14,400  
Strokes Per Minute—7200 down-cutting, 7200  
upward, non-cutting. REPELLING SAFETY strokes.  
Needs no motor, no oil. Lasts lifetime. Portable.  
Plug in—saw! If Dealer hasn't it, send  
\$12.75 check, M.O., we'll ship postpaid  
in U.S.A. only. Satisfaction Guar-  
anteed. Write for FREE CATALOG!

GIVE **SYNCRO** WORLD'S SAFEST SAW FOR  
XMAS!

SYNCRO DEVICES INC.  
3265 Bermuda  
Dept. PS-121  
Ferndale-Detroit, Michigan

GENUINE

## SpeedWay



DRILL \$9.95 GRINDER \$9.95

KIT \$17.95

ELECTRIC TOOLS

Backed by 30 years of electric tool  
leadership. Correct designs and  
speeds . . . specially wound high  
torque 110V universal SpeedWay  
Tool Motors. 1000 RPM Drill has  
pistol grip, die cast case and 1/2"   
capacity in steel. 20,000 RPM  
Hand Grinder has 1/4" and 1/2"   
collets. Sold individually or in  
Steel Kit with 5 accessories. Stand  
takes Drill or Grinder. Frame con-  
verts Grinder into Router. Bench Grinder  
is complete with motor and 2 wheels. All cords  
waterproof with un-  
breakable plugs.



SPEEDWAY MFG. CO.

1824 S. 52nd Ave., Cicero, Ill.

Why Guess When Experts Choose  
**AUTO-LITE BATTERIES**

**NOW a DYNAMIC  
HEAVY DUTY  
INDUSTRIAL WELDER** for Only \$19.75

**WORKS OFF 110-Volt Light  
Socket.** This marvelous **\$19.75**  
Dynamic Power Welder does the  
work of much higher priced types. It is  
easily portable. **WELDS Cylinder Blocks,  
Bumpers, Fenders, Tanks, Farm Machinery,  
etc.** Will also solder and braze on the lightest  
material. Works on iron, steel, tin, brass, cop-  
per and all other metals. Men without previous  
experience can make as much as \$5.00 on a one  
hour repair job. In a year's time a **Dynamic Welder**

**COSTS LESS THAN 6 CENTS A DAY**

Go into business—Open a welding shop now. **AGENTS**—Make big  
profits selling to garages, factories, janitors and machine shops.  
Write today for our 10-DAY TRIAL OFFER. **DYNAMIC WELDER  
COMPANY, 2226-ST SILVERTON ROAD, CHICAGO, ILLINOIS**

وَالْمُؤْمِنُونَ إِنَّمَا يَنْهَا عَنِ الْمُنْكَرِ وَمَا يَنْهَا عَنِ الْمُنْكَرِ إِلَّا مَا يَرَى

$$\text{Tr}(\mathbf{A}^T \mathbf{A}) = \text{Tr}(\mathbf{A}^T \mathbf{A}) - \text{Tr}(\mathbf{A}^T \mathbf{A}) + \text{Tr}(\mathbf{A}^T \mathbf{A}) = 0.$$

This one



UFY4-827-4HN1



MODEL CC  
WITH  
PHOTO-ELECTRIC  
EXPOSURE  
METER

\$ 35.50

Fine  
American Made  
Cameras

Pictures in  
Gorgeous Kodachrome  
are easy to make with  
all Argus Cameras  
**argus**  
ann arbor michigan

FREE "CHOOSING YOUR CAMERA"  
Write for this 32 page booklet

## FREE HOLLYWOOD ENLARGEMENT

Just to get acquainted, we will make a beautiful PROFESSIONAL enlargement of any snapshot, photo, kodak picture, print, or negative to 5 x 7 inch FREE. Please include color of eyes, hair, and clothing for prompt information on a natural, life-like color enlargement in a FREE FRAME to set on the table or dresser. Your original returned with your FREE PROFESSIONAL enlargement. Please send 10c for return mailing—Act quick.

HOLLYWOOD FILM STUDIOS

7021 Santa Monica Blvd., Dept. 156, HOLLYWOOD, CALIFORNIA



### WARD'S CAMERA BOOK will save YOU money!

#### Prices Same for Terms or Cash

Ward's prices are "rock bottom" on every fine camera (still or movie) catalogued—most merchandise is shipped **Postpaid**. You also can save money on all other equipment: film, paper, chemicals, etc. There is **no carrying charge** for Terms. Every purchase made at Ward's is guaranteed to satisfy. Send for Camera Catalog without delay—today.

**MONTGOMERY WARD & CO., Dept. PS-1241, CHICAGO, ILL.**

*Write* FOR MY  
NEW  
Still Bargaining  
No. 250  
... it's Free!

... Lists Thousands of  
NEW and USED STILL  
CAMERAS and AC-  
CESSORIES. Also  
CINE Catalog No.  
245. Write Dept. PS

**Bass**  
CAMERA CO.

**Bass** CAMERA CO.  
179 W. MADISON ST., CHICAGO, ILL.

### FREE bargain BOOK

#### First Step to Successful Pictures

Free illustrated catalog, crammed with hundreds of new and used bargains. Lists everything photographic—still and movie cameras, films, lenses, equipment—at tremendous savings. Liberal trade-in allowances. Satisfaction guaranteed or your money back. 10-day trial. Write for your FREE copy—just out. Hurry!

**CENTRAL CAMERA CO., Dept. L-18**  
230 South Wabash Avenue, Chicago, Illinois Since 1899

### WORLD'S GREATEST all around ELECTRIC TOOL

DRILLS—GRINDS—SANDS—SAWS  
POLISHES—SHARPENS—CARVES

The new WHIZ ELECTRIC TOOL is the handiest power tool ever made. A rugged tool for power and precision work. Drills through 1/4 inch iron plate in 42 seconds or engraves intricate designs. Handles any material: Metals—Woods—Alloys—Plastics—Glass—Steel—etc. Saves time. Eliminates labor. Plug into any socket AC or DC, 110 volts. Chuck 1/4 inch capacity. Ball bearing thrust. Powerful, triple-gearred motor. STANDARD MODEL with Normal Speed (uses 200 different accessories, instantly interchangeable). Price only \$7.95.

The only DRILL-TOOL with a full year's guarantee

**FREE** Accessory outfit (Value \$2) includes set of drills, mounted 1 1/2 inch grinder, sanding discs, cutting wheels, mounted brush, polishing wheel, carving bur, etc. FREE with each tool ordered NOW. We pay postage.

10-DAY TRIAL—MONEY BACK GUARANTEE

Paramount Products Co., Dept. 12-C, 545 Fifth Ave., New York

ONLY  
\$7.95  
POSTPAID  
GUARANTEED  
FOR ONE YEAR

WHEN  
YOU *must* GET THE PICTURE!

...be sure  
of perfect  
exposure with  
a WESTON



For treasured pictures like this, where there's but one opportunity to make the shot, there's a simple, sure way of getting a perfect picture... without danger of under- or over-exposure. In fact, every picture you take with your still or movie camera... in- or out-of-doors... can be life-like and rich in detail, correctly exposed. All you need is a WESTON Exposure Meter. By quick, accurate light measurement, this compact, easy-to-use device gives you the correct camera settings to use... the settings which insure a correctly exposed picture every time! Eliminates all guesswork and uncertainty... prevents film losses and picture disappointments. Be sure to see the WESTON at your dealer's.

A FREE BOOKLET is available which gives the inside story on photographic exposure... shows why you are so often disappointed... tells how you can get perfect pictures every shot with a WESTON. Write for your copy today. Weston Electrical Instrument Corporation, 622 Frelinghuysen Avenue, Newark, N. J.

**WESTON**  
EXPOSURE METERS



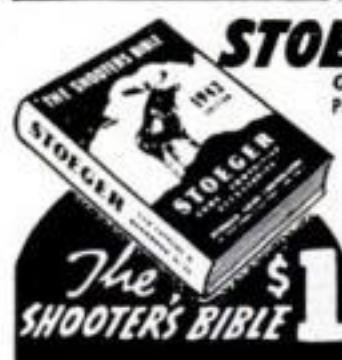
### U-MAK-IT New AQUAMOBILE V-18



No  
experience  
necessary.

Cut-to-Fit for quick home assembly. Avoids motor shortage problem. Get used Ford motors A, B, V8, Chevrolets, etc. for trifle. Adjustable motorbeds fit all. Assembled frames ready for installation. Fast VEE bottom Marine Plywood hulls. **SEND 10c MONEY SAVING CATALOGS** also show kits for Kayaks, Rowboats, Outboards, Dinghies. Latest designs & construction details.

KAYAK BOAT CO., 152R-East 129 St., New York, N. Y.



**STOEGER** NEW! 1942  
CATALOG & HANDBOOK  
GUNSMITHING for PLEASURE or  
PROFIT. Only complete Gun Tool Section for amateur

and professional. 512 Pages—16,000 Items—

6,000 Pictures. Shotguns & Rifles, Pistols &

Revolvers. Ammunition. Thousands of Accessories.

NEW ITEMS: All Major Outdoors Sports Equipment.

Better than ever from cover to cover.

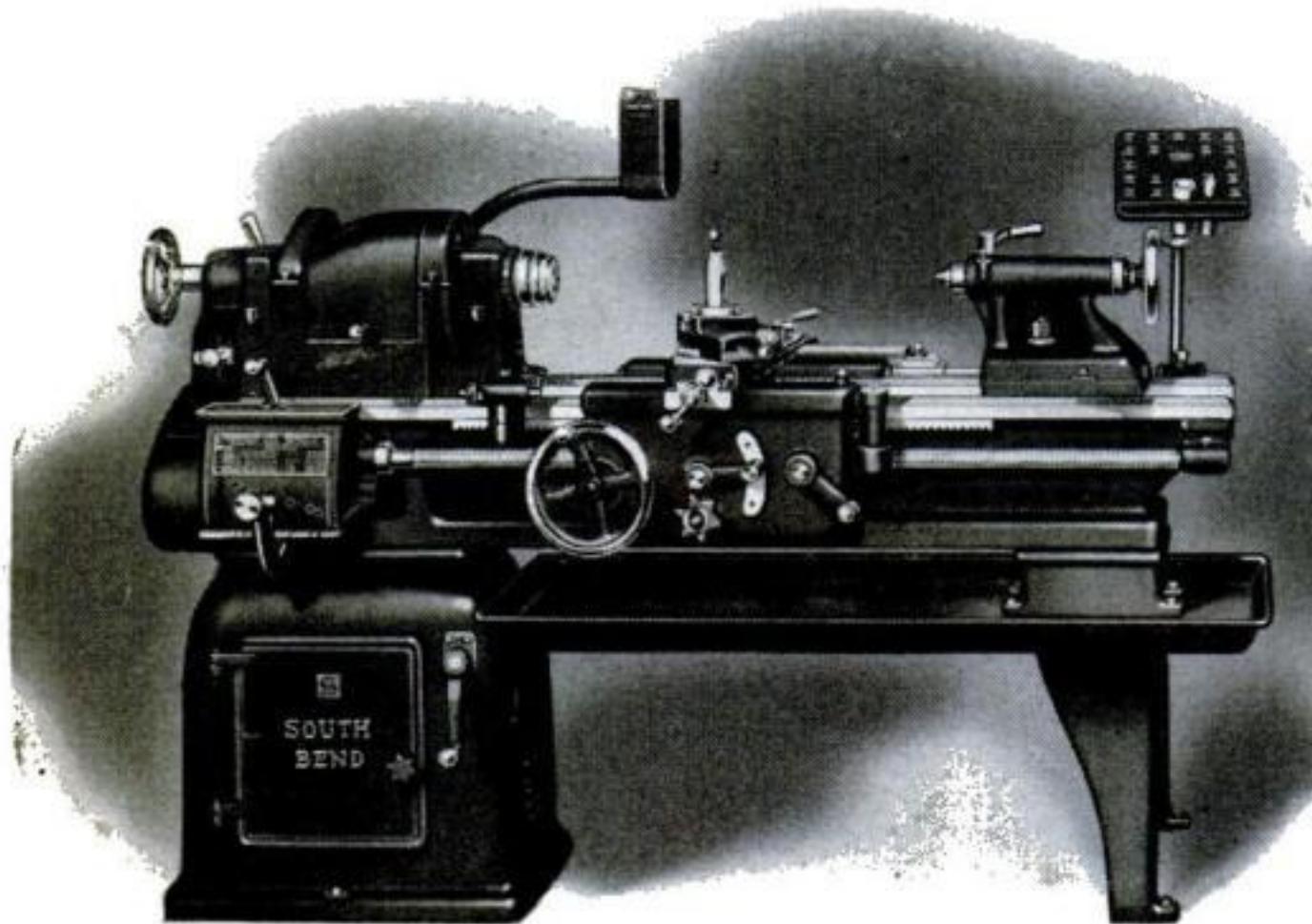
Send a **Dollar Bill**, check or stamps, for

this big improved volume NOW.

**STOEGER ARMS CORP.**  
507 FIFTH AVE. (at 42nd St.) NEW YORK, N. Y.

Featuring  
FOR THE  
FIRST TIME  
YEAR-ROUND  
IN-AND-  
OUTDOORS  
SPORTS  
EQUIPMENT

# For MODERN SHOPS



## *South Bend Lathes*

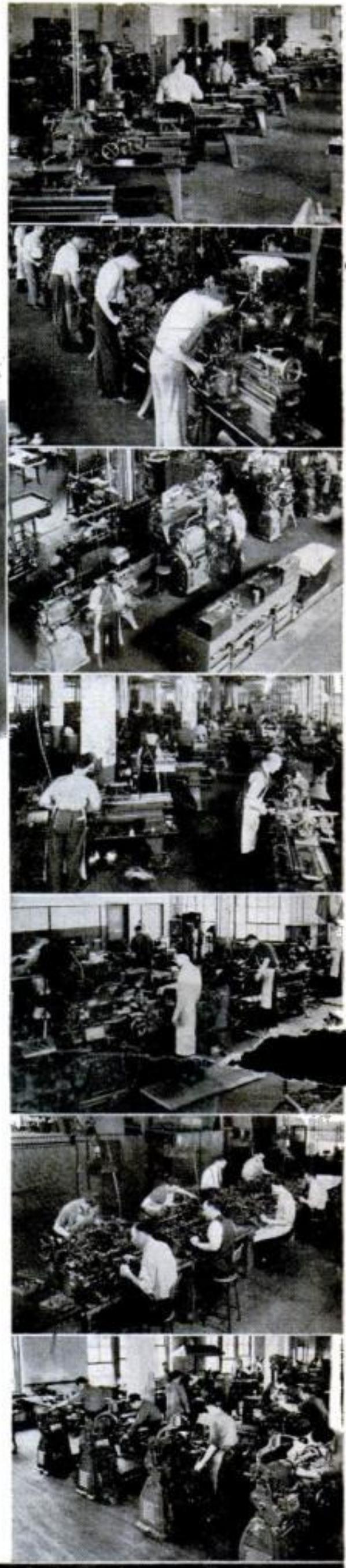
**SOUTH BEND LATHES** are designed and built to give efficient service in modern shops. Because they are known to be dependable, permanently accurate, and versatile, thousands of them have been ordered for the National Defense Industries, the Army and Navy—and prompt deliveries have been specified. Our Production schedules have doubled and redoubled. Delivery promises have been met and are being met *every day!* South Bend Lathes are made faster than ever before.



But no sacrifice in quality has been made to speed up the production of South Bend Lathes—nor will there be a lowering of our standards. The same rigid inspection tests—the same skilled workmanship—the same high quality materials will be maintained. South Bend Lathes are made in five sizes: 9", 10", 13", 14½", and 16" swing, 3' to 12' bed lengths, in Tool Room or Manufacturing types, with countershaft or motor drive. Write for a catalog and name of your nearest dealer.

**SOUTH BEND LATHE WORKS**  
829 EAST MADISON ST., SOUTH BEND, IND., U.S.A.

LATHE BUILDERS SINCE 1906





# Thousands of Machinists Wanted!

Get Started for a Big Pay Job With This

# NEW ENCYCLOPEDIA OF MACHINE SHOP PRACTICE

...a reading course and reference book in one big volume...FOR ONLY

To Every POPULAR SCIENCE Reader! Claim Your  
Copy WHILE SUPPLY LASTS. Rush Your Order  
on Attached AIR MAIL CARD at Our Expense!

AMERICA'S rapidly expanding industries are calling for machinists and more machinists! The demand is greater than the supply! Rates of pay were never higher! What an opportunity for men who like work that combines the skill of hands and brains! For such men anxious to get started in this profitable field, we have published the NEW ENCYCLOPEDIA OF MACHINE SHOP PRACTICE at the sensationally low introductory price of \$1.98. Our first announcements brought an overwhelming response from POPULAR SCIENCE readers. We were fortunate in

being able to pick up several carloads of paper at the old prices, so we rushed arrangements for a huge additional printing. But with costs soaring and materials getting scarcer, we cannot guarantee to supply this edition for very long. You are urged to RUSH your order on the postage-paid AIR-MAIL POSTCARD attached. Hand the Courtesy Order Card (also AIR MAIL) to any friend who may also want to order a copy.

This amazing book shows you in almost 1,000 crystal-clear illustrations and easy to understand text exactly how every function of the machinist is performed! Written by practical experts in simple language so that even the beginner can make rapid progress; a ready reference work also for every machine operator, metal worker, draughtsman or mechanic.

Describes and Illustrates Every Basic Machine Shop Operation

Covers Every Problem that Confronts Even the Expert Machinist

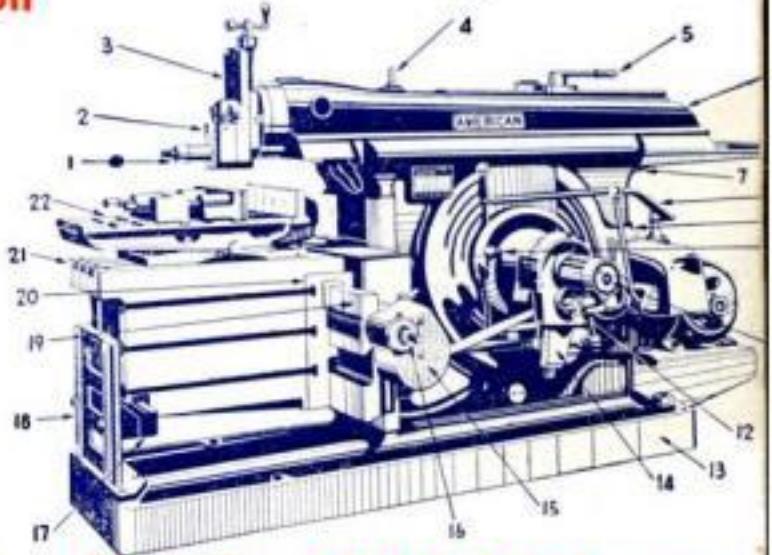
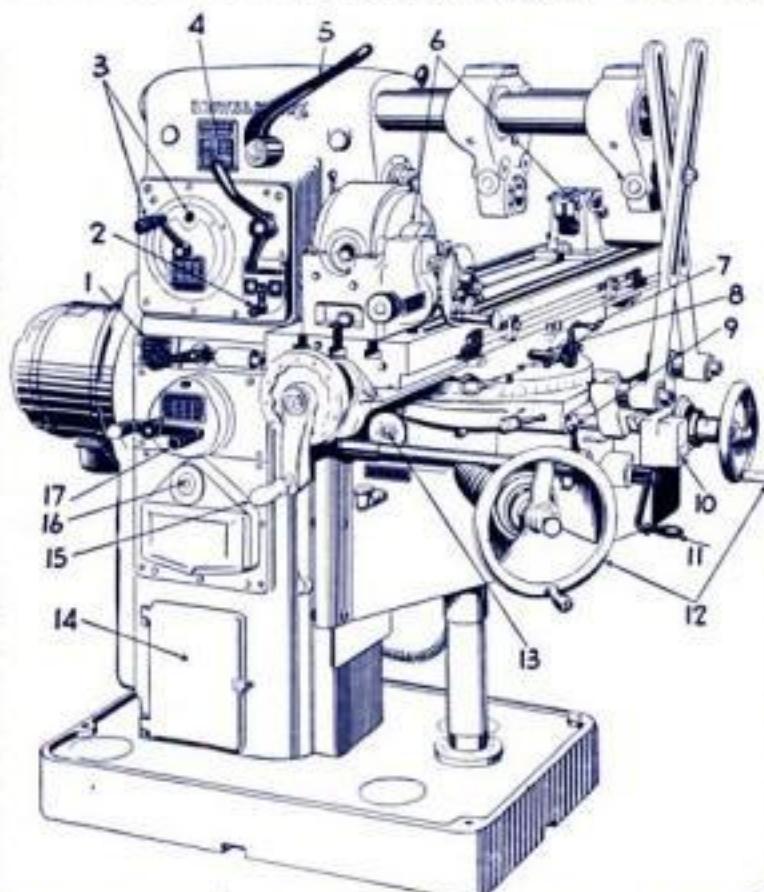
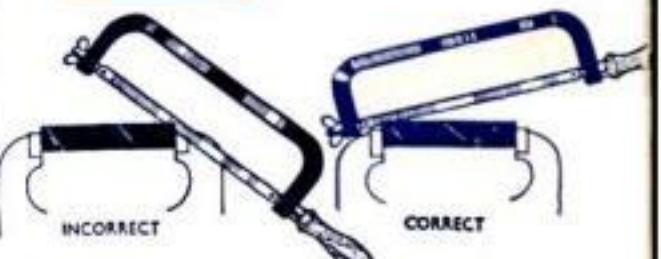
COMPLETE chapters in this volume are devoted to every type of Bench Work; different types of metal used by the machinist; Turret and Automatic Lathes, and their innumerable functions, attachments and operations. There are chapters covering every type of Screw-Cutting; Taper-Turning; Knurling; Milling and Grinding.

Included in the broad scope of this volume is full information on Special Machine Tools and Machine Attachments; Jigs and Fixtures; Punch Press Operations. Instruction is given in Heat-Treating of Metals; Welding and Soldering; Drop-Forging; Foundry Work; Gauging and Testing. Complete descriptions and explanations of all types of Calipers, Micrometers and other precision measuring instruments used by machinists are included. There is also a special chapter on Reading Machine Blue Prints. And there are dozens of tables designed to save time for the machinist and to simplify mathematical calculations.

Copyright, 1941, by Wm. H. Wise & Co., Inc.

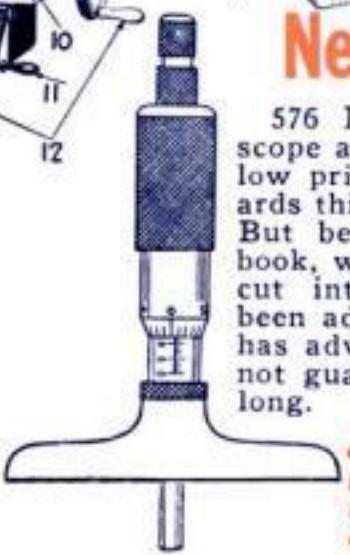
**\$1.98**

An Amazing  
Bargain!



**Nearly 1000 Pictures**

576 Pages. Imagine a work of this size scope and importance offered at the incredibly low price of \$1.98! By ordinary price standards this volume should sell for around \$10.00. But because there is a great need for this book, we are experimenting with a drastically cut introductory price. However, we have been advised that the paper used in this book has advanced 42% in cost. Therefore we cannot guarantee the low price of \$1.98 for very long.



To avoid disappointment, RUSH your order now via the postage-paid AIR-MAIL POSTCARD attached. Hand the extra AIR MAIL POSTCARD to a friend. Wm. H. Wise & Co., 8012, 50 West 47th St., N.Y.

Copyrighted material

With MAUREEN O'HARA  
it's Chesterfield for Christmas  
She is appearing in the  
20th Century-Fox Production  
"HOW GREEN WAS MY VALLEY"



FOR CHRISTMAS

*It's Chesterfield*

*Here are your Milder Better-Tasting  
Chesterfields again . . . in the most attractive, up-to-the-  
minute Christmas gift package of the year.*

*Buy them for the folks at home . . . send them to your friends  
and don't forget to mail them to the boys in the Service.*

*YOU CAN'T BUY A BETTER CIGARETTE* *They Satisfy*